348

pH/Blood Gas/Electrolytes/ Haematocrit/Analyzer

Service Manual

Chiron Diagnostics

106122 Rev A 10/96

The 348 Blood Gas Analyzer is designed for fast and accurate measurement of whole blood.

The 348 measures pH, pO2, pCO2, Na, K, Hct and either Ca or Cl and uses a sample volume of 95µl.

The service manual contains complete instructions for servicing the 348.

Warning

The 348 is designed to be grounded through the power supply lead (line cord) for safe operation. For the safety of operating personnel make sure that the instrument is only connected to 3-prong sockets (outlets) that have an effective earth connection. If you are in any doubt as to the safety of your electrical supply system consult a competent qualified electrician.

There are no user replacement parts within the instrument. Do not remove the covers from the 348.

Chiron Diagnostics and their Authorized Distributors and Agents consider themselves responsible for the effects on safety, reliability and performance of the 348 only if:

i) Assembly operations, extensions, re-adjustments, modifications or repairs are carried out by persons authorized by them.

ii) The electrical installation of the relevant room complies with IEC requirements or the local regulatory code, and

iii) The equipment is used in accordance with the instructions for use.

The information contained in this manual was correct at time of going to print. However, Chiron Diagnostics policy is one of continuous product improvement and the right to change prices, specification, equipment and maintenance procedures at any time, without notice, is reserved.

The 348 Analyzer is classed as IEC Type B equipment (Class 1 Equipment providing an adequate degree of protection against electric shocks particularly regarding allowable leakage currents and reliability of the protective earth connection).

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1.1 Introduction

The 348 is a direct reading blood gas/electrolytes/haematocrit analyzer. Results and operator interaction are performed via a multiline, 40 character vacuum fluorescent display and a numeric keypad.

The 348 is designed for fast, accurate determination of pH, pO_2, pCO_2, Na, K, Hct and either Ca or Cl. It is also capable of measuring Barometric Pressure. Certain calculated parameters are also available based on the measured data.

Parameter	**Symbol**	
Actual bicarbonate	HCO_3^-act	
Standard bicarbonate	HCO_3^-std	
Base excess (extra cellular fluid)	BE (ecf)	
Base excess (blood)	BE (B)	
Total carbon dioxide	$ctCO_2$	
Adjusted calcium	Ca^{++} (7.4)	1
Anion gap	AnGap	2
Oxygen saturation	O_2SAT	
Oxygen content	O_2CT	3
Alveolar/arterial difference	pO_2 (A-a)	4
Arterial/alveolar ratio	pO_2 (a/A)	4
Oxygenation ratio	pO_2 (a/F_I0_2)	4
Estimated haemoglobin	ctHb (est)	5

Notes:

1. Available only if Ca is fitted
2. Available only if Cl is fitted
3. Utilises tHb if entered, otherwise uses tHb (est). If neither estimated or entered tHb is available then O_2CT is not available
4. Available only if F_IO_2 is entered
5. Is overridden by entered tHb

2.1 User controls and displays (refer to Figure 1)

Alpha numeric display

Multi-line 40 character vacuum fluorescent display for presentation of results, operator options and status information.

Printer

32 character dot-matrix thermal printer for recording results, calibration and set-up data.

Keypad

15 key keypad consisting of 10 numeric keys 0-9, # key, * key, clear (c) key, decimal point (.) key and paper feed key.

The keypad is used to initiate instrument operations, enter data and respond to display instructions.

For full details of keypad/display interaction see section 2 of the instruction manual.

Probe lever

The probe lever can be raised to one of two possible sampling positions, syringe or capillary. Presentation of the sample will automatically initiate the operational sequence. A third position allows removal of the probe carriage assembly.

2.2 Rear and side panel connectors (refer to Figure 2)

Power

Input AC power connection incorporating fuses and voltage selection.

Data output

2 data output ports, Port 1 and Port 2. Both are 9 way ‘D’ type connectors. Port 1 is a female connector for RS232 communication only, and Port 2 is a male connector for use as both RS232 communications, and a bar code reader.

Gas chassis

Two access holes for insertion of cal and slope gas cartridges.

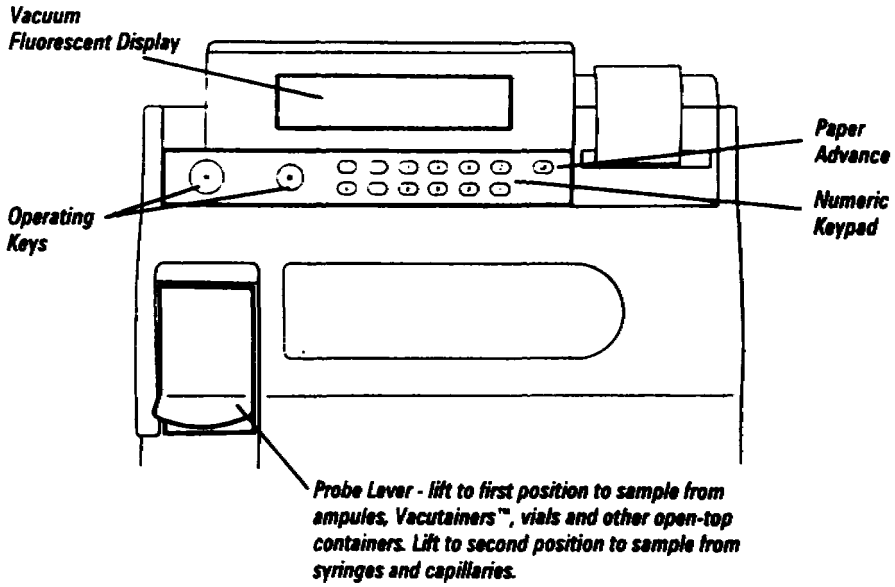

Vacuum
Fluorescent Display
Paper
Advance
Numeric
Keypad
Operating
Keys
Probe Lever - lift to first position to sample from ampules, Vacutainers™, vials and other open-top containers. Lift to second position to sample from syringes and capillaries.

Figure 1

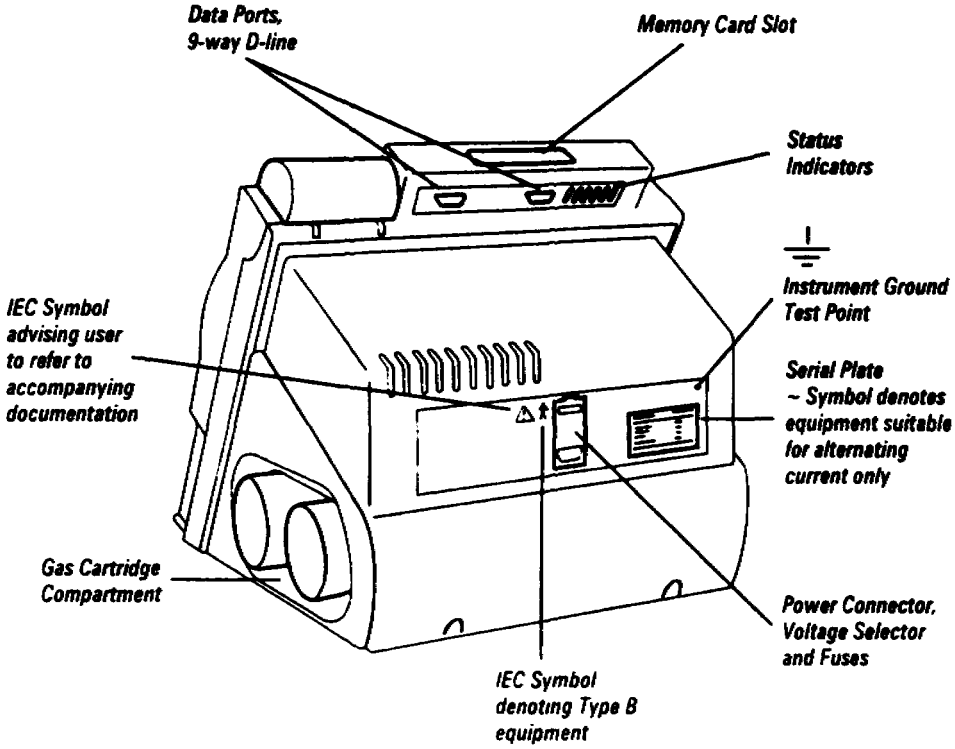
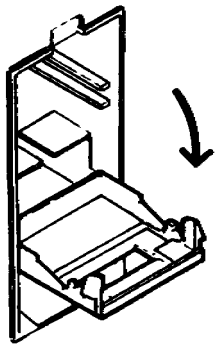


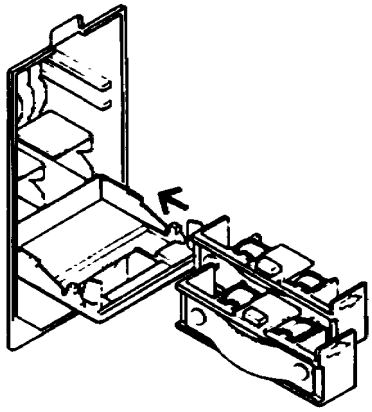
Figure 2

2.3 The Rear Panel - selecting voltages

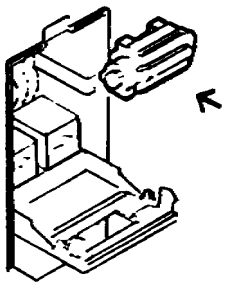
Open the voltage selector cover with the screwdriver supplied.



Insert the two fuses into the fuse holders and slide the fuse holders into the voltage selector.



Select the voltage required for the local supply

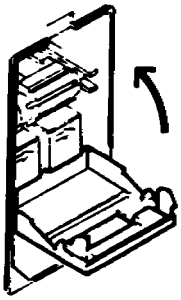


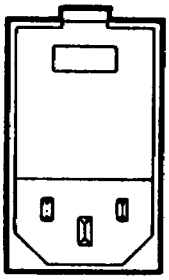
2.3 The Rear Panel - selecting voltage (cont'd)

Voltage selected	Voltage range
100V	85V to 110V
120V	102V to 132V
220V	187V to 242V
240V	204V to 264V

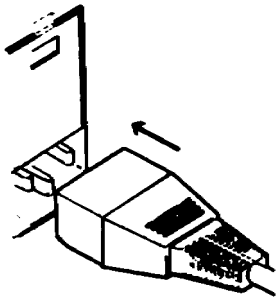
Slide the voltage selector bobbin into the voltage selector so that the selected voltage is visible when the voltage selector cover is closed.

CAUTION: Do not rotate the bobbin when it is fitted in the voltage selector as this will damage the contacts.





Close the voltage selector cover



If necessary, connect a suitable plug to the line cord. Connect the line cord to the power connector on the rear panel.

Note: Do not permanently affix the line cord to the power supply.

3.1 General

The 348 Blood Gas Analyzer/electrolyte/haematocrit Blood Gas Analyzer is available to comply with UL/CSA and IEC regulations. Several languages are also available. Consult your local Chiron agent to decide on which version is appropriate for your customer.

3.2 Structural

The casework of the instrument is a combination of plastic mouldings and sheet metalwork. The main body structure is a plastic moulding which has mounted on it the main hydraulic components - solenoid valves, pump, etc. The electrode block is mounted to the front of the moulding as is the probe assembly.

The power plate is of folded sheet metalwork fitted to the rear of the gas chassis. This plate has the main power inlet and transformer fixed to it.

The gas chassis is of sheet metal construction with two regulator/pressure switch assemblies mounted on the left had side. A plastic moulding with two gas cartridge guide tubes fits into the gas chassis and covers the right had side of the instrument. The two gas cartridges slide into the two access tubes and are screwed into position.

The main electronic components are mounted on the main body moulding at the top of the instrument. The keypad and display are also mounted on the display moulding which fits to the top of the main body moulding.

A cover with a viewing window is hinged to the sides of the main body moulding. This cover can be raised to give access to the system for maintenance and troubleshooting. The viewing window allows for the sample path visibility. During aspiration of the sample path is illuminated.

The electronic system consists of the following:

The CPU board, a power supply/interface board, an amplifier board, a multiplexer board, a probe interface board, a display module and a printer. The amplifier board and multiplexer board fix together to form an amplifier assembly.

The CPU board is mounted on the display moulding. The power supply/interface board is mounted at right angles to the CPU board and plugs directly into it, through a slot in the main body moulding. The display module and keypad fit into the display the display module moulding which fits to the top of the main body moulding. The amplifier assembly is integral with the electrode block, and the probe interface is integral with the probe assembly. The printer occupies the top right hand corner of the main body moulding.

The instrument software is incorporated in a ROM card which is accessible through a slot in the top of the instrument. It plugs directly into the CPU board, and the slot is sealed with a flexible rubber strip.

3.3 Hydraulics System

Please refer to Figure 3 when reading the following description.

The main hydraulics system consists of a perspex manifold mounted on the front of the main body moulding. The solenoid valves which control the various reagents and gases are mounted directly onto the manifold. Tubing systems then direct the reagents and gases to the appropriate points in the probe and electrode block.

Calibration gases are fed into V4 which selects the appropriate gas required for the current operation. The output of V4 is then fed into V2, which either vents the gas to the weir area, or feeds it via V3 into the sample path via the first tee-junction.

Wash solution is controlled by V1 which allows recirculation of the wash, or directs it to the probe.

Calibration solution is controlled by V5 which recirculates it or directs it via V3 into the sample path via the first tee-junction.

Slope solution is controlled by V6 which recirculates it or directs it into the sample path via the second tee-junction.

Fluid flow is controlled by two pumps. The sample/waste pumps the excess reagent which collects in the weir to waste via P2 and the outflow from the sample block to waste via P5. P2 and P5 are on the sample pump roller assembly.

The three reagents, wash, cal and slope are pumped by the P1, P3 and P4 tubes on the reagent pump roller assembly.

Sample positioning is controlled by SD1 and SD2 which are optical detectors. For short samples which can result in the auto split sample mode being initiated, the Hct sensor acts as a sample detector.

3.4 Electronic system.

Please refer to Figure 4 when reading the following description.

The instrument is under software control from a microprocessor which executes the program resident on the plug-in ROM card. All associated CPU circuitry (chip decoding, RAM, interrupt control etc) is located on the CPU board. This board also provides interfacing to the display module, printer, keypad and data ports.

The CPU board receives power from the Power Supply board and provides signals interfaces to the rest of the system. The Power Supply board converts AC power to the DC power required by the electronic circuitry and also provides interfaces for the fan, the reagent and sample motors, all the solenoids, the probe assembly, the BP sensor and the electrode block assembly.

All analog signals in the system are fed via a multiplexer to the A/D converter which is situated on the Power Supply board.

3.5 Gas chassis

Please refer to Figure 5 when reading this section.

The two gas mixtures required, cal and slope, are supplied in two gas cartridges. These cartridges screw into a regulator/pressure switch assembly. The pressure switches activate at a level of 1 bar, and this prompts the user via the display to change the cartridges. The regulator is pre-set to 5psi. The gases then pass through a filter (which is part of the regulator/pressure switch assembly) into a restrictor comprised of a length of peek tubing. The gases then enter the manifold via a further filtered connection.

4.1 Introduction

The following description of how to disassemble the 348 should be used in conjunction with the relevant figures and exploded views. Before carrying out any procedure which required power to be disconnected from the 348 the pre-service protocol (section 4.2) should be performed.

Note: When carrying out any procedure which involves handling of printed circuit boards, anti-static precautions should be taken.

4.2 Pre-service Protocol

i) Access system set-up in the main menu and initiate set-up printout (#67).

ii) On completion of the set-up printout, remove and retain for future reference.

iii) Disconnect instrument from the main electrical supply.

iv) Carry out service procedure.

v) Perform post-service protocol.

4.3 To replace the power supply board

Parts required:

PSU board Cat No. 106225

Note: Anti-static precautions should be followed for this procedure.

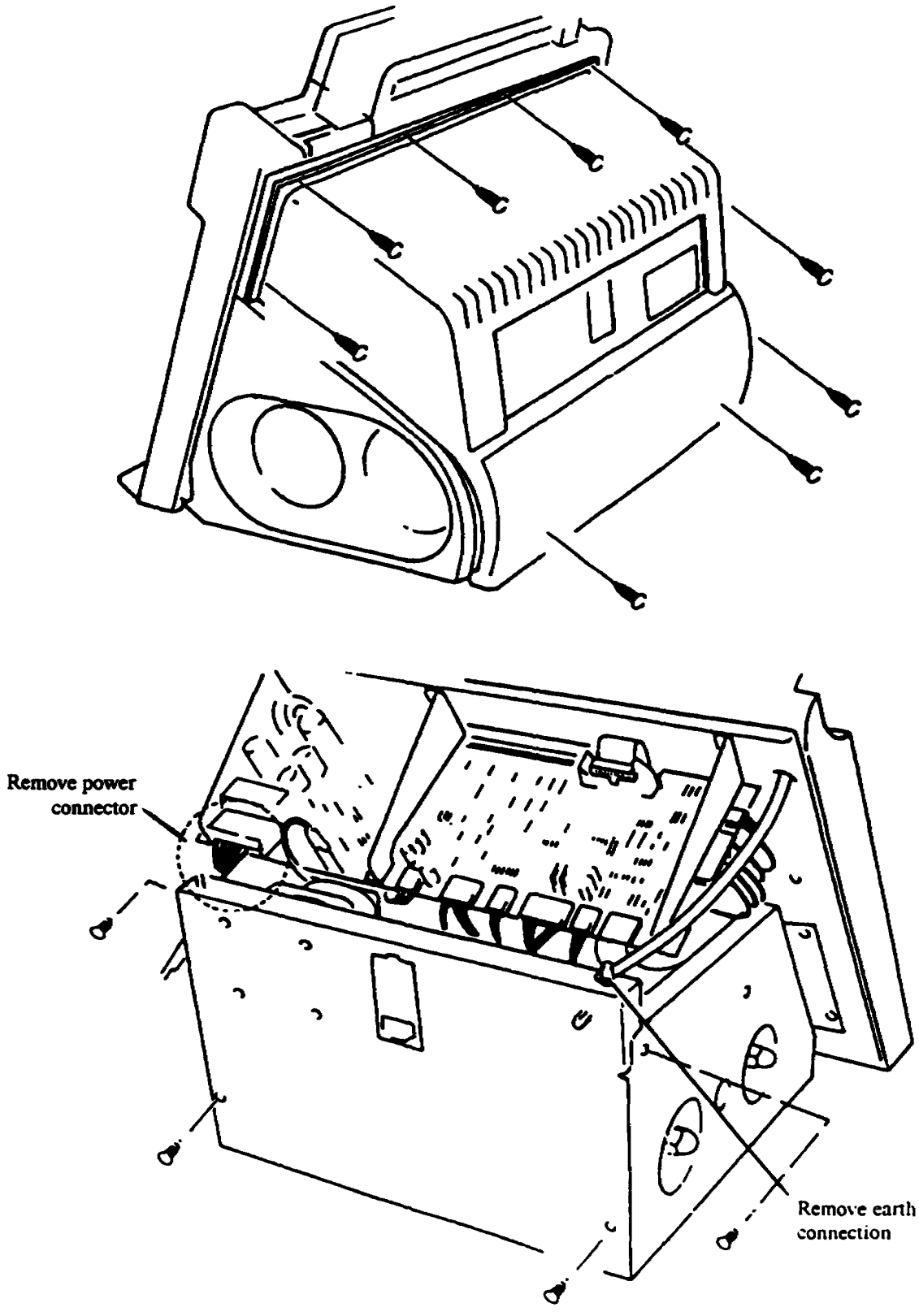
Power down the 348.

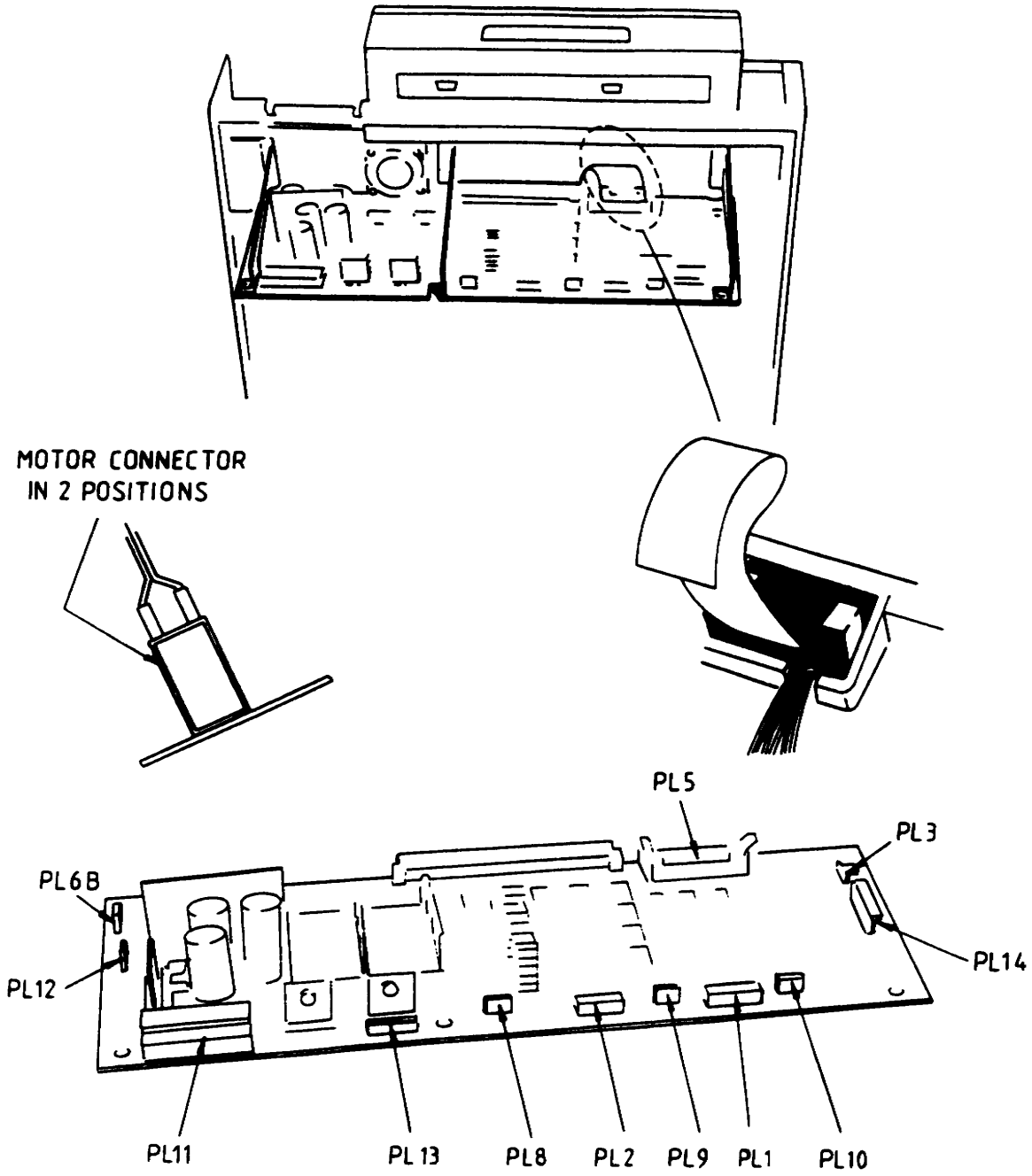
Remove the nine screws holding the rear cover in place. Note that the two screws fixing the bottom of the rear cover are longer than the rest. Remove the rear cover. Disconnect the transformer connection to the power board (PL11). Disconnect the earth lead on the right hand side of the rear panel (as viewed from the rear). Remove the four screws holding the rear panel in place. Remove the rear panel.

Disconnect all remaining connections to the PSU board PL1-PL6, PL8-PL10 and PL12-PL14.

Remove the three screws holding the board in place at the ends of each of the three support brackets.

Remove the board carefully, ensuring that none of the components on it foul against the support brackets. The PSU board can now be replaced.


Remove power
connector
Remove earth
connection


MOTOR CONNECTOR
IN 2 POSITIONS
PL5
PL3
PL6B
PL14
PL12
PL11
PL13
PL8
PL2
PL9
PL1
PL10

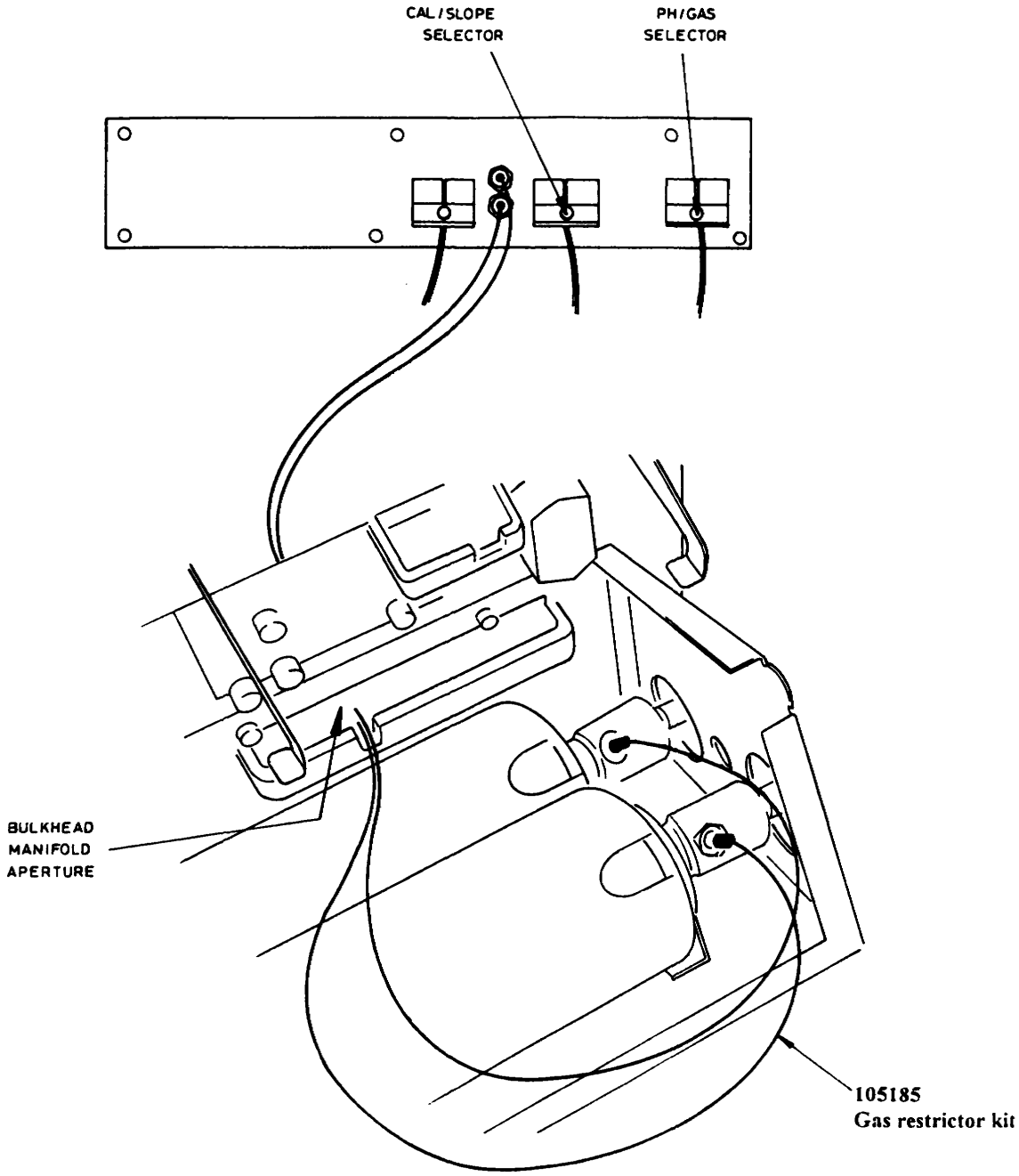
4.4 To replace the gas restriction tubing

Parts required:

Gas restrictor kit Cat No. 105185

Power down the 348.

First remove the rear cover and rear panel as described in section 4.3. The gas chassis should now be exposed. Unscrew the gas cartridges and set aside (removing the gas restrictor tubing with the gas cartridges in place will result in venting of the gas cartridges). Follow the procedure for removing the manifold (section 4.18). This gives access to the restrictor tubing at the manifold end. Slide off the tubing support collars at both ends. Remove the tubing. Replace as necessary. When replacing the restrictor tubing, take great care to ensure the connections are properly made, as even a small leak will result inconsiderably shorter gas cartridge life.


CAL/SLOPE
SELECTOR
PH/GAS
SELECTOR
BULKHEAD
MANIFOLD
APERTURE
105185
Gas restrictor kit

4.5 To replace the regulator/pressure switch assemblies

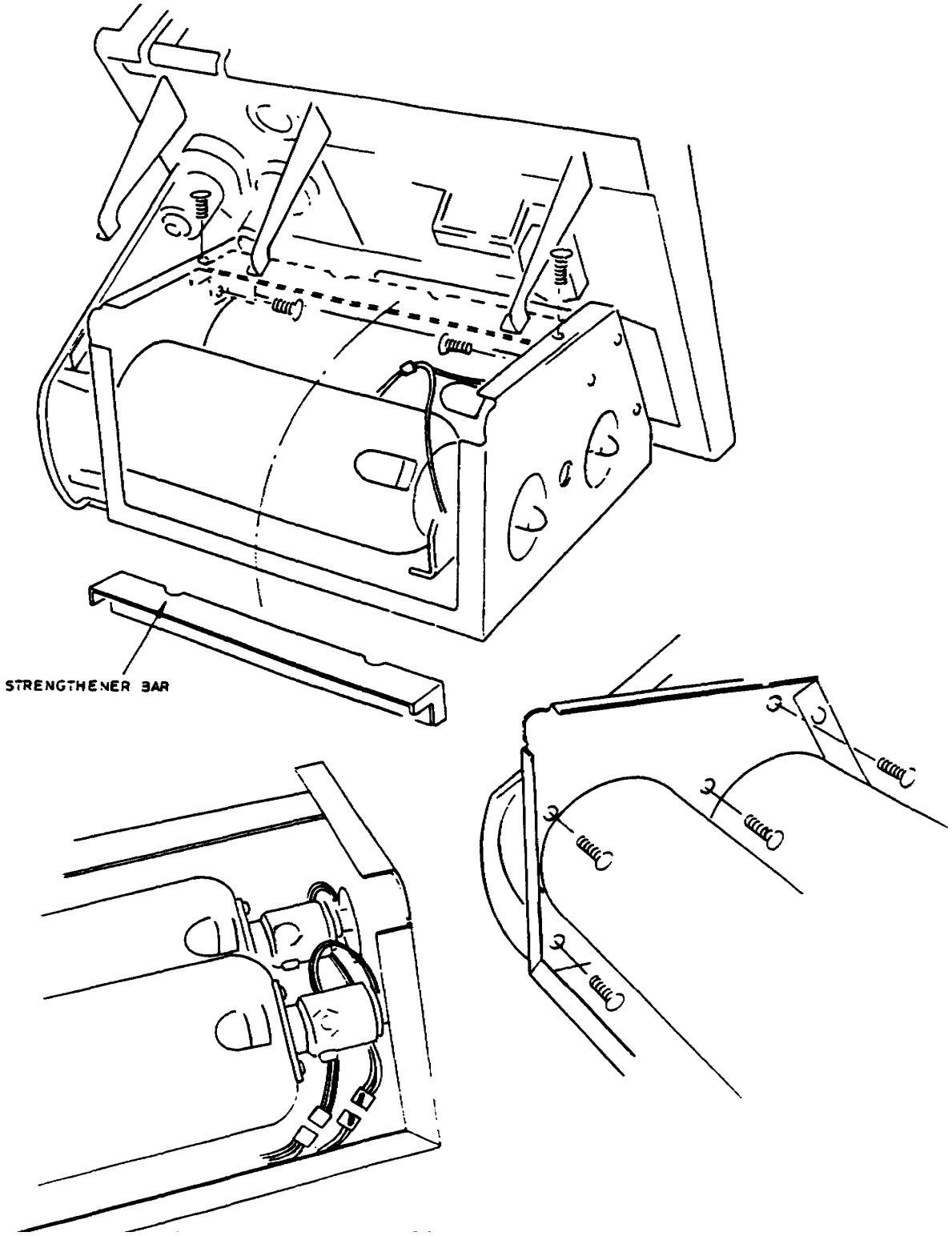
Parts required:

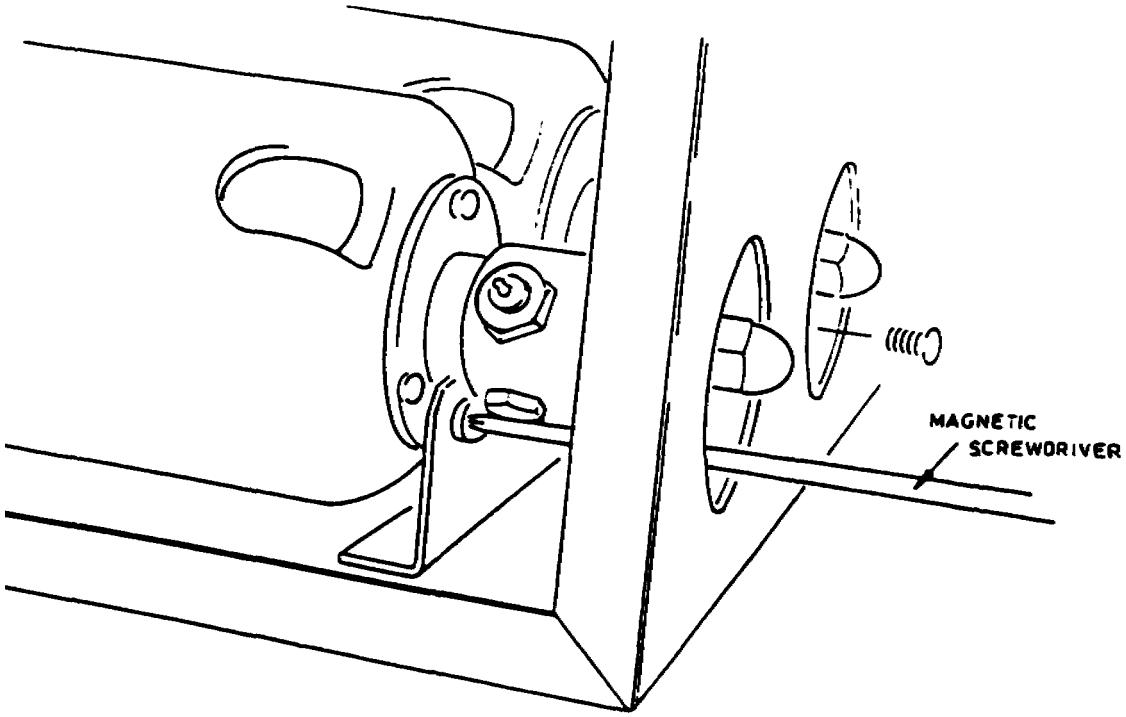
Gas regulator/pressure switch assembly Cat No. 105170

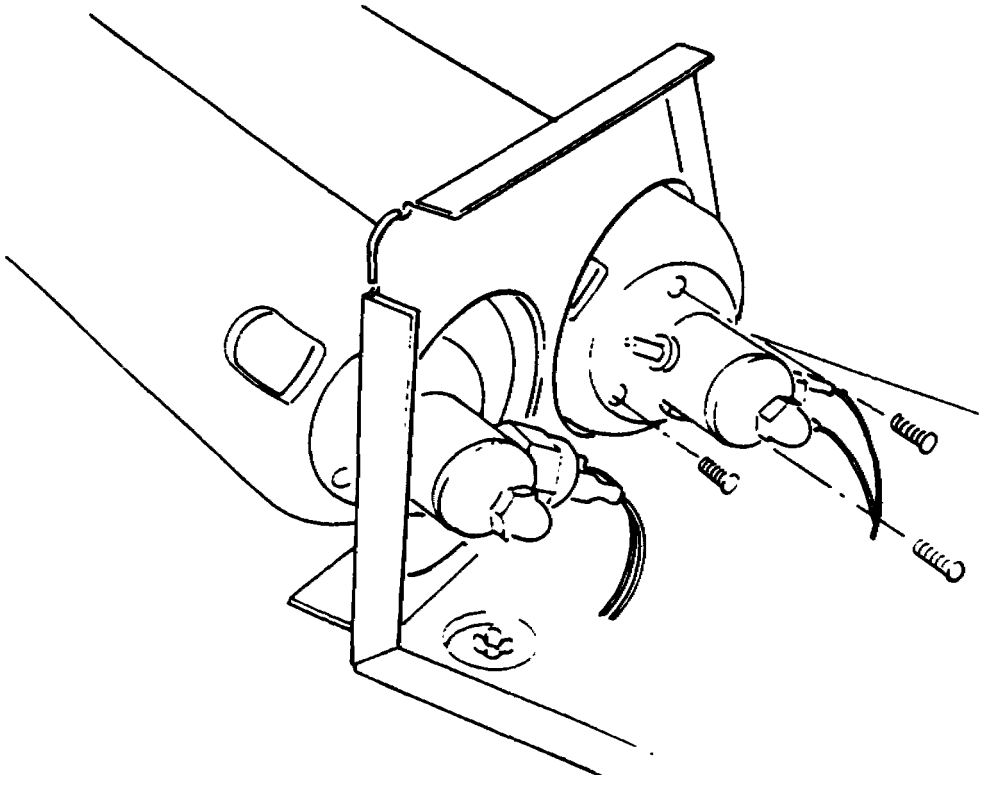
Power down the 348.

Remove the rear cover, rear panel and PSU board as described in section 4.3, the gas cartridges and restrictor tubing as described in section 4.4.

Remove the strengthening bar on the gas chassis by undoing the four screws which retain it. This gives access to the four screws holding the gas cartridge moulding in place. Remove the four screws holding this moulding in place at this end; remove the two screws underneath the regulators holding the cartridge moulding assembly to the base strut at the end. Pull the top of the moulding backwards and out from where it is retained by the main moulding. Slide the moulding out far enough to give access to both regulator pressure switch cables. Remove the required assembly by undoing the three retaining screws holding it in place on the gas cartridge moulding.


STRENGTHENER BAR


MAGNETIC
SCREWDRIVER



4.6 To replace the CPU board

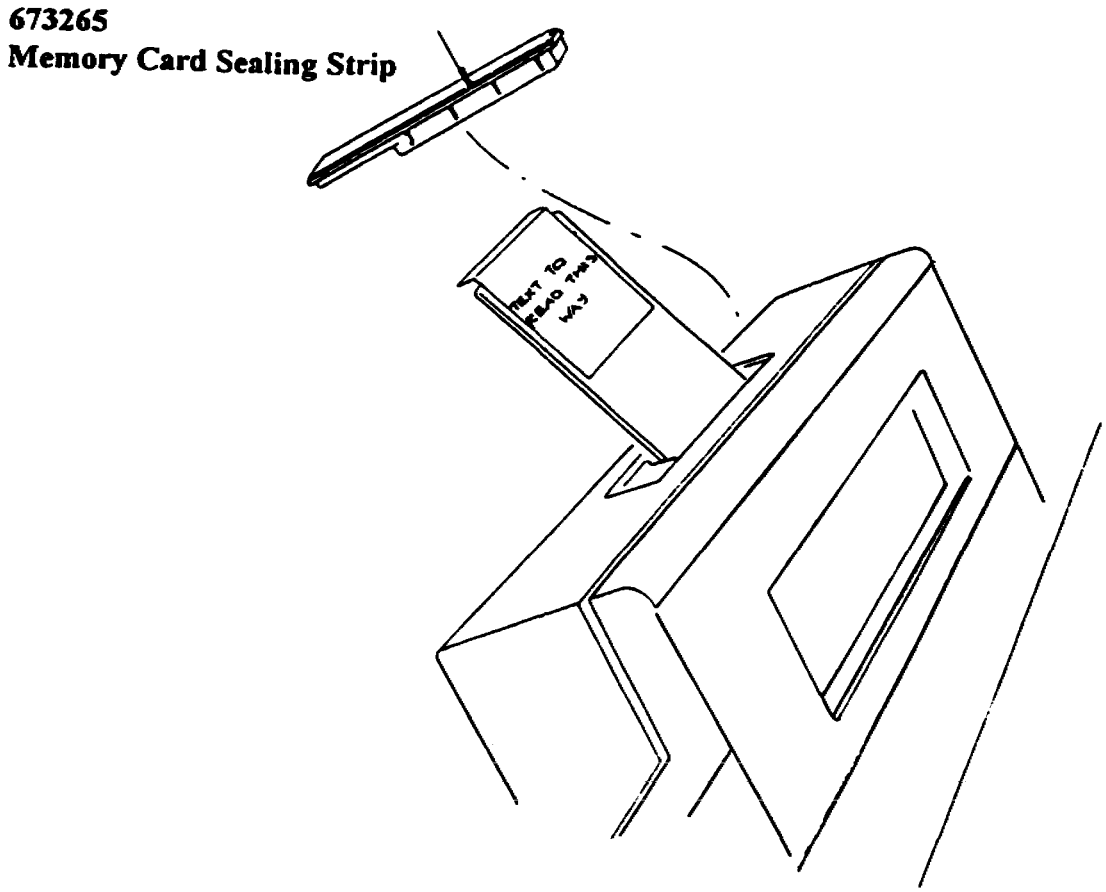
Parts required:

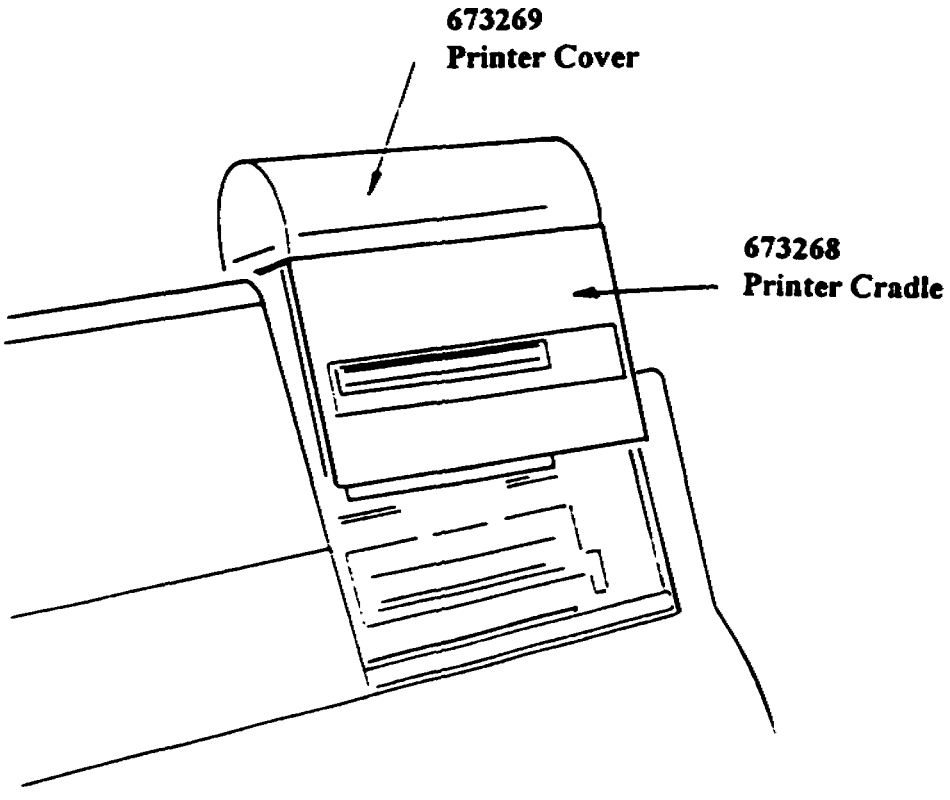
CPU board Cat No. 106195

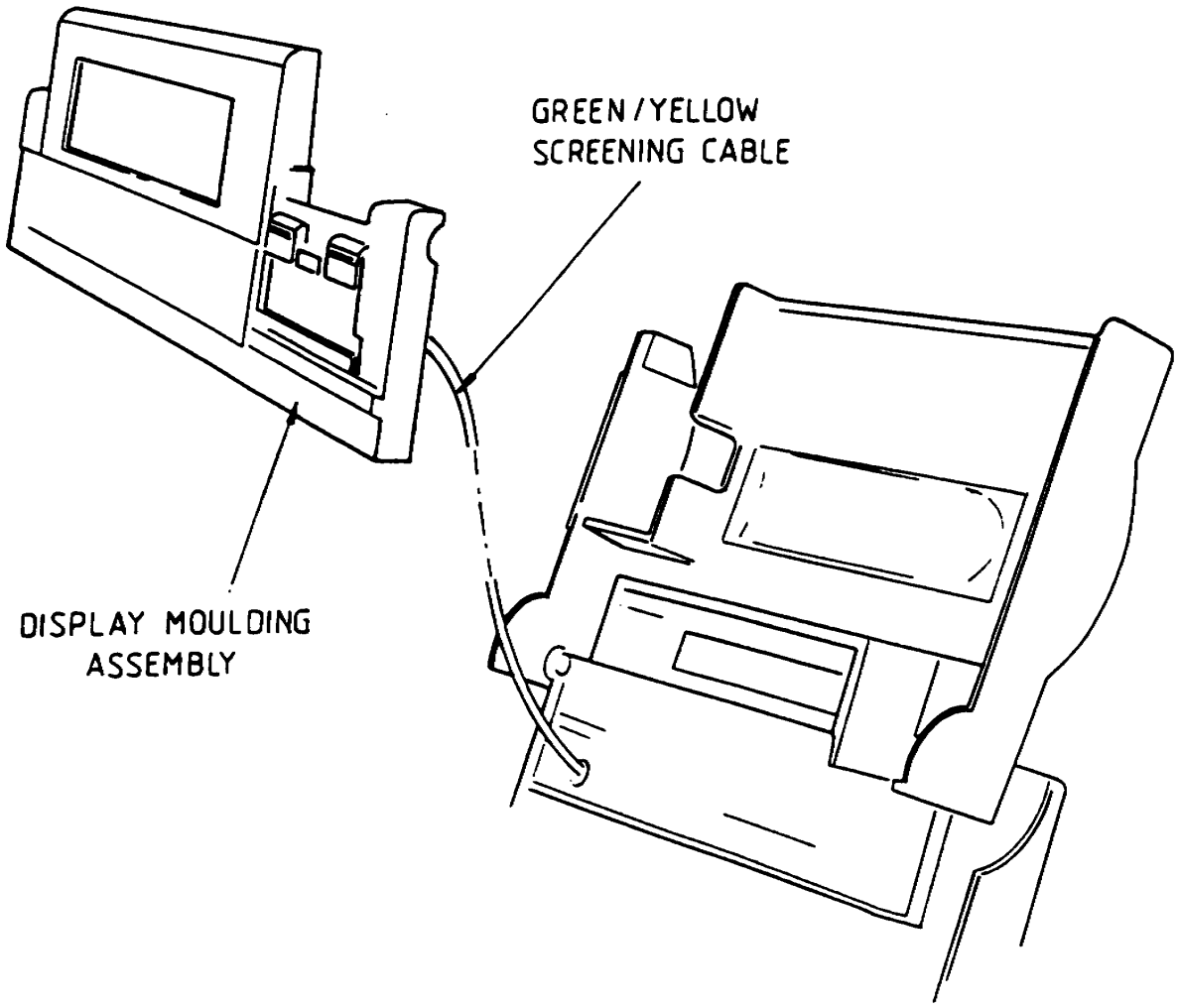
Power down the 348.

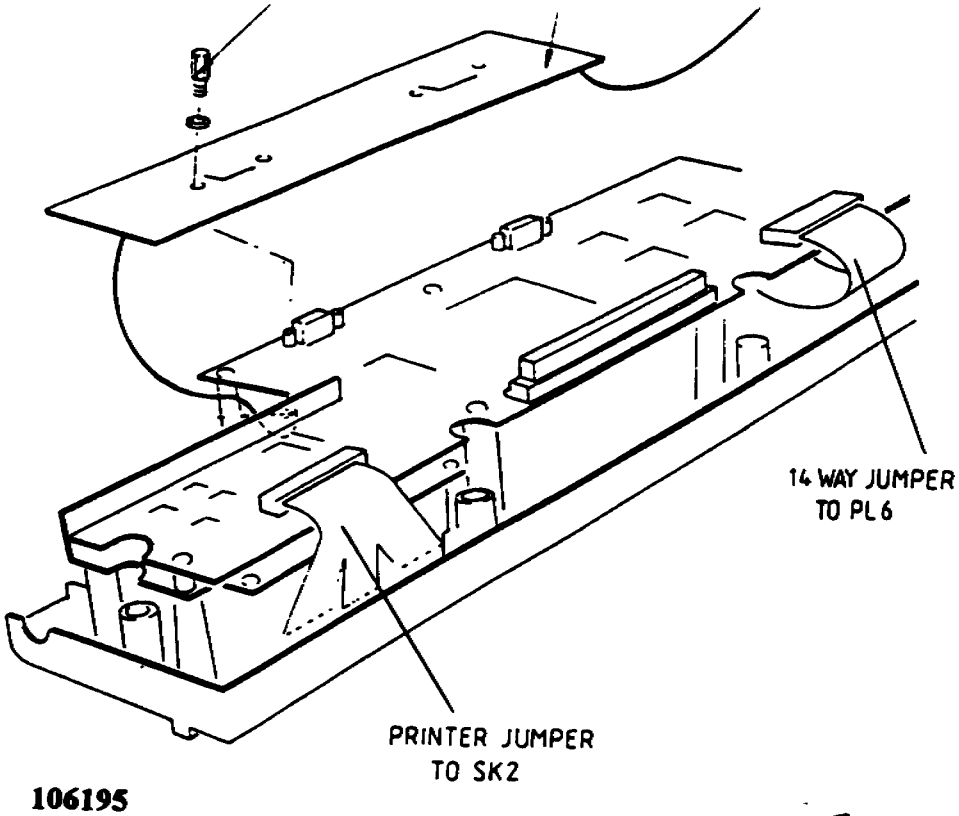
First remove the rear panel and the PSU board as described in section 4.3. Remove the memory card from its slot beneath the rubber seal on the top of the display moulding. Remove the six screws retaining the display/printer/keypad/CPU sub-assembly. Remove the printer paper from the printer and slide the printer cradle and cover up to remove them.

Raise the instrument cover to the upright position. Pull the sub-assembly forward, away from the main instrument. Thread the earth strap through the hole in the main moulding. Place the instrument cover to one side (ensure the two bearing bushes are retained in place on the cover). Lay the sub-assembly face down on a protective surface to prevent scratches occurring on the front panel. Remove the earth connection to the stud on the printer tray. Remove the metal grill from the board by unscrewing the four hex nuts on the two data ports. Remove the six screws holding the CPU board in place. Disconnect the 26 way ribbon cable at the top left-hand corner of the board and the two power connections in the centre at the right hand side of the board. Disconnect the keypad connector at the bottom left hand side of the PCB. Disconnect the printer head connector sliding the outer cover of the connector towards the bottom of the CPU board and then sliding the connector tail out. Lift the CPU board clear of the sub-assembly. Note that the screw in the bottom left hand corner of the board is longer than the others and passes through a spacer to the printer assembly. The CPU board can then be replaced.

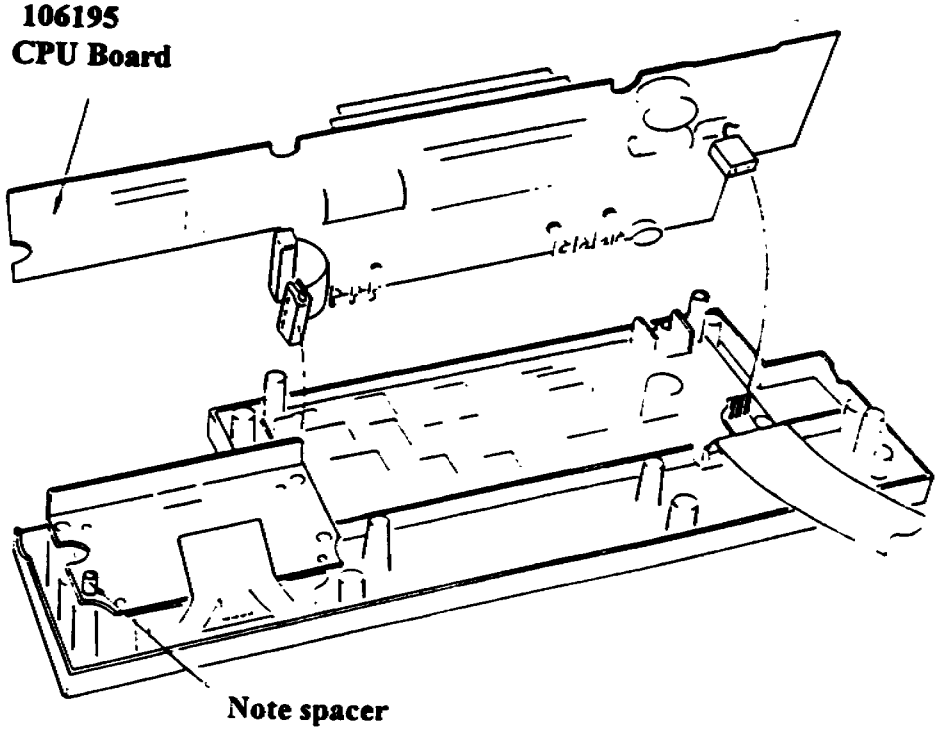

673265
Memory Card Sealing Strip


673269
Printer Cover
673268
Printer Cradle


GREEN/YELLOW
SCREENING CABLE
DISPLAY MOULDING
ASSEMBLY



106195
CPU Board



4.7 To replace the printer

Parts required:

Printer head Cat No. 673267

Follow the procedure described in section 4.6 to remove the CPU board. Once the CPU board is removed, the printer head can be removed by unscrewing the three remaining screws on the printer tray, and then removing the printer head from the printer tray and replacing.

4.8 To replace the Display Module

Parts required:

Display Module Cat No. 673263

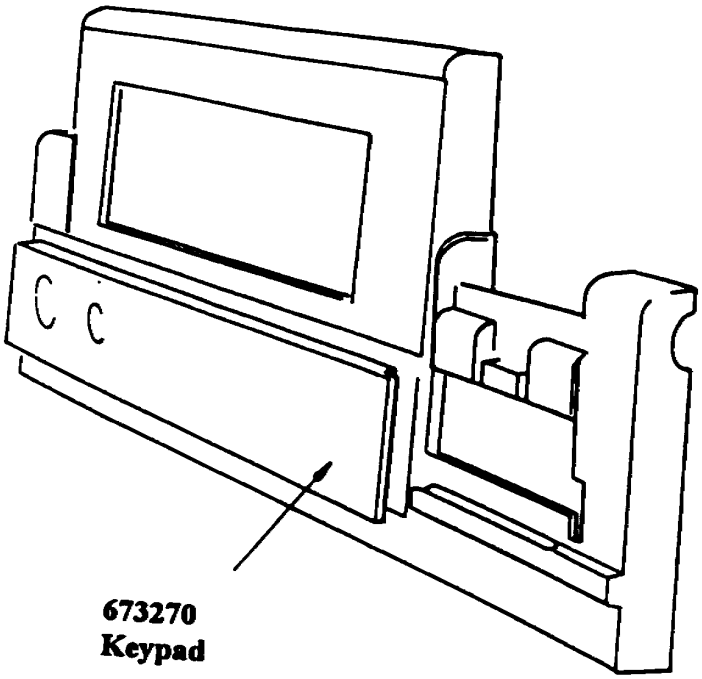
Follow the procedure described in section 4.6 to remove the CPU board. Unscrew the two pillars at the top of the display board, and remove the two screws at the bottom. The display module can now be lifted out and replaced.

4.9 To replace the keypad

Parts required:

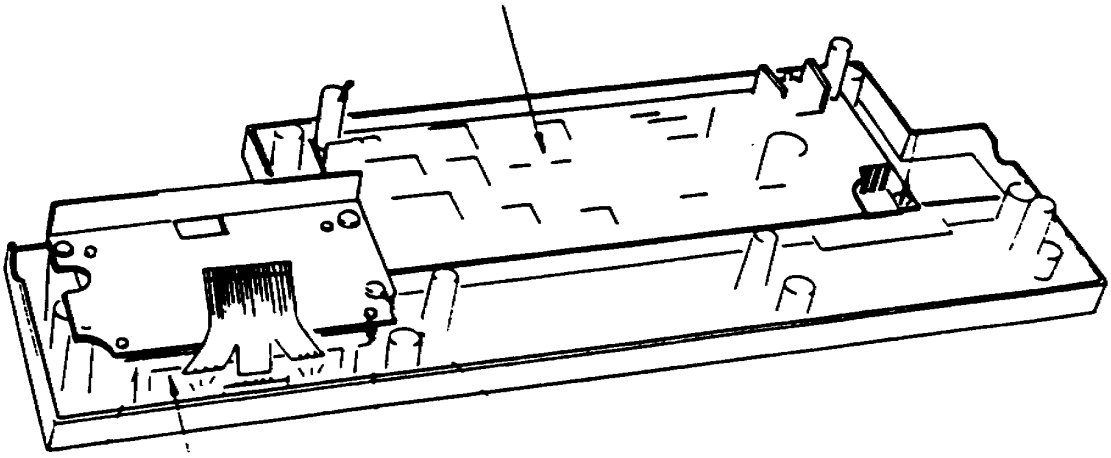
Keypad Cat No. 673270

Follow the procedure described in section 4.6 to remove the CPU board. Remove the eight nuts and washers which retain the keypad in place. The keypad can now be removed from the front panel and replaced.



673270
Keypad

673263
Display Board



673267
Printer Head

4.10 To replace the motor/gearbox assemblies

Parts required:

Motor/gearbox Cat No. 478666

Power down the 348

Remove the pump tube cassette from the relevant rotor cage. Unscrew the rotor screw in the end of the rotor cage. Slide the rotor cage off the motor shaft. Remove the locating pin from the motor shaft. Remove rear cover, panel and PSU as described in section 4.3. Unscrew the two fixing screws, one at each side of the motor/gearbox assembly. Withdraw the assembly through the bulkhead and replace.

4.11 To replace the fan

Parts required:

Fan Cat No. 474745

Follow the procedure described in section 4.3 to remove the rear panel. Disconnect the fan from the PSU board. Unscrew the four retaining screws and remove the fax and replace.

4.12 To replace the BP sensor

Parts required:

BP sensor Cat No. 813014001

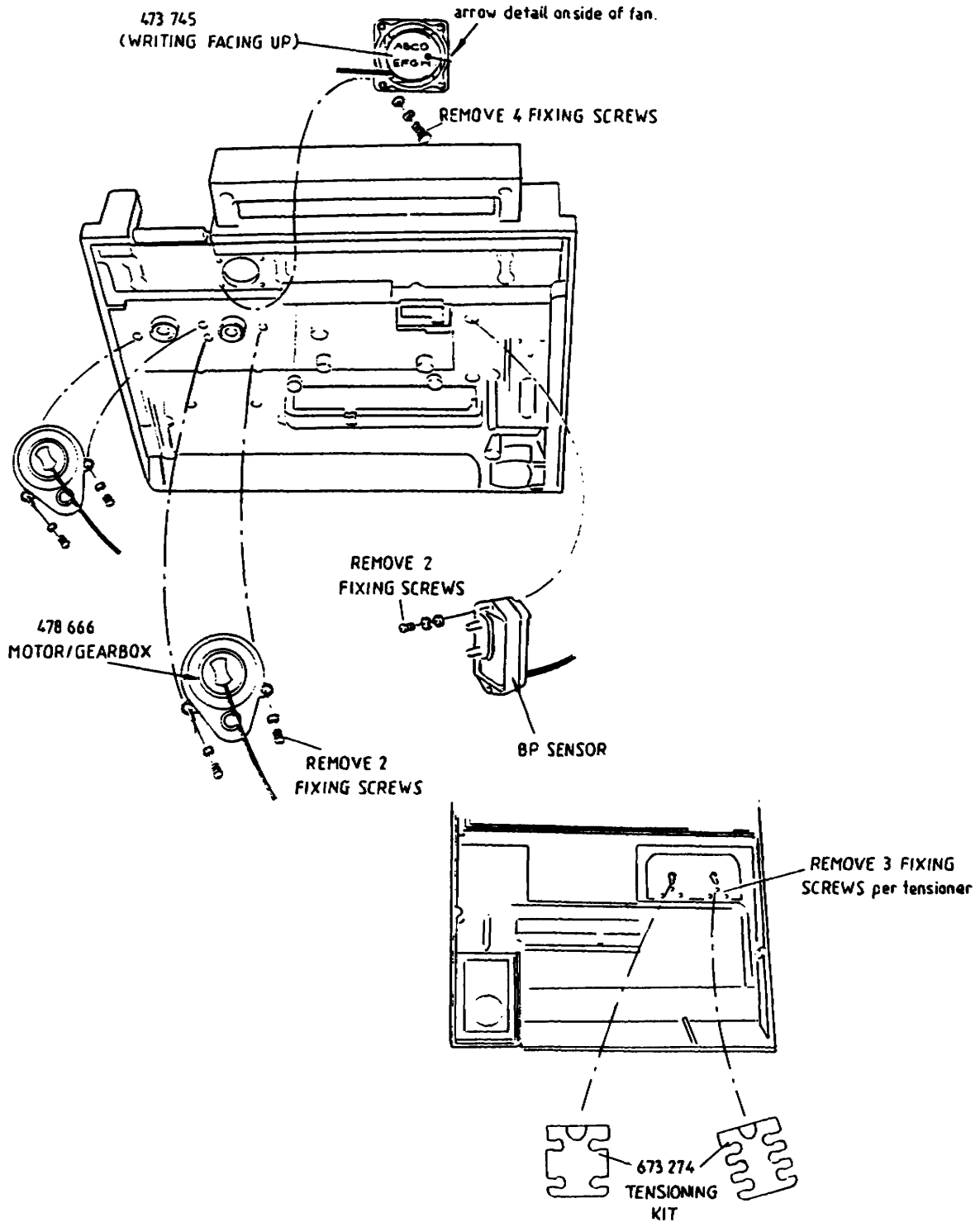
Follow the procedure described in section 4.3 to remove the rear cover, panel and PSU board. Unscrew the two retaining screws and remove the BP sensor and replace.

4.13 To replace the tube tensioners

Parts required:

Tube tensioning kit Cat No. 673274

Follow the procedure described in section 4.3 to remove the rear cover, panel and PSU board. Follow the procedure described in section 4.4 and 4.5 to remove the gas cartridge assembly.


473 745
(WRITING FACING UP)
arrow detail on side of fan.
REMOVE 4 FIXING SCREWS
REMOVE 2
FIXING SCREWS
478 666
MOTOR/GEARBOX
BP SENSOR
REMOVE 2
FIXING SCREWS
REMOVE 3 FIXING
SCREWS per tensioner
673 274
TENSIONING
KIT

The two tube tensioners (one with three tube positions and one with two tube positions) are held in place with three screws removable from the rear of the bulkhead. The three position tensioner is located on the left-hand side of the bulkhead when viewed from the rear, and the two position tensioner is more central to the bulkhead. They can then be reached.

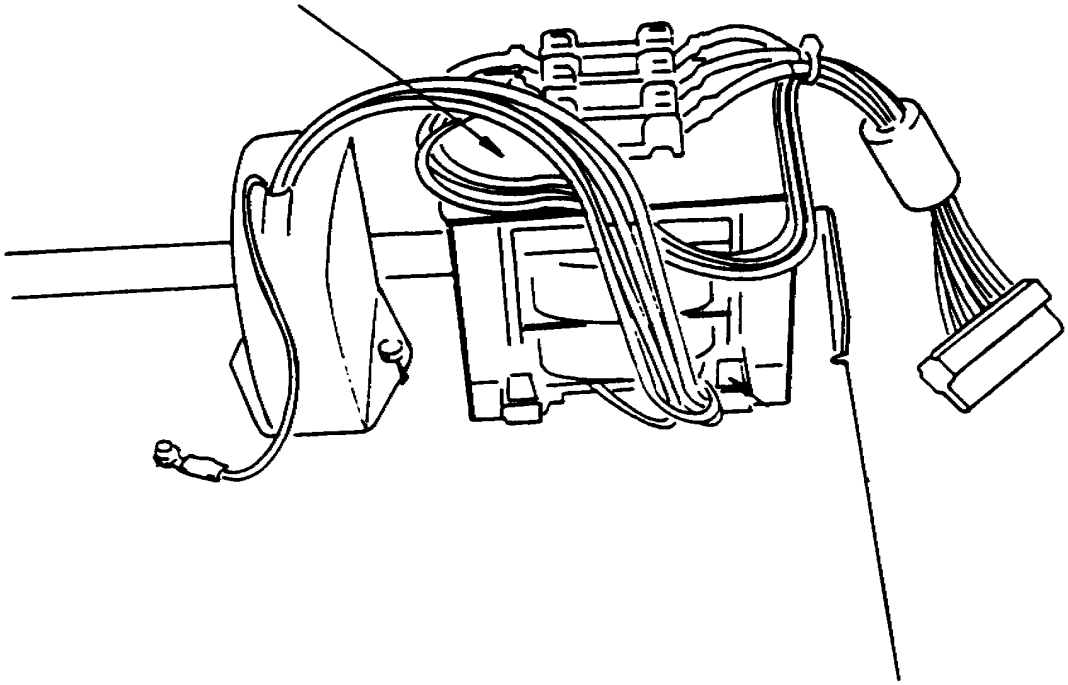
4.14 To replace the transformer assembly

Parts required:

Transformer assembly Cat No. 105223

Follow the procedure described in section 4.3 to remove the rear panel. Remove the nut holding the earth lead in place. Remove the two nuts retaining the voltage input selector. Undo the four screws retaining the transformer in place. The transformer assembly can now be replaced.

105223
Transformer Assembly



4.15 To replace the probe lever

Parts required:

Probe lever Cat No. 673285

First remove the probe carriage by disconnecting it from the pre-heater input, and then raising the probe to its topmost position and sliding the probe carriage out. The probe lever can then be removed by squeezing the two sides together sufficiently to release the lever. It can then be replaced.

4.16 To replace the probe bracket

Parts required:

Probe bracket Cat No. 673286

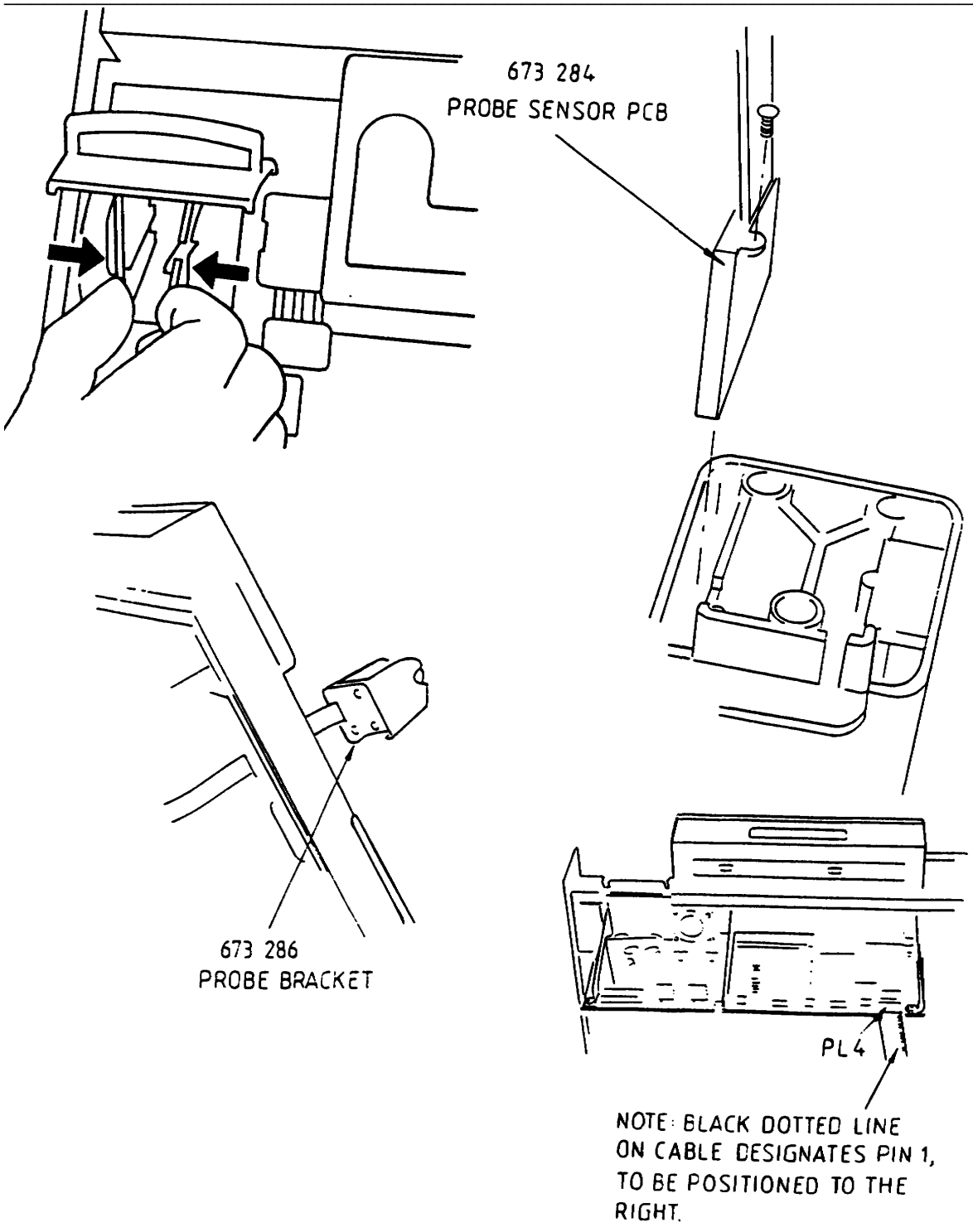
Follow the procedure described in section 4.3 to remove the rear cover and panel. Disconnect the front cable from the PSU board. Unscrew the three retaining screws holding the probe bracket in place and remove the bracket, sliding the flat cable connector through the hole in the bulkhead. The bracket can then be replaced.

4.17 To replace the probe sensor

Parts required:

Probe sensor Cat No. 673284

Remove the probe bracket assembly as described in section 4.16. The probe sensor can be removed by unscrewing the single retaining screw on the left-hand side of the assembly (when viewed from the rear), and removing the sensor assembly for replacement.


673 284
PROBE SENSOR PCB
673 286
PROBE BRACKET
PL4
NOTE: BLACK DOTTED LINE ON CABLE DESIGNATES PIN 1, TO BE POSITIONED TO THE RIGHT.

4.18 To replace the Manifold or Solenoid assemblies

Parts required:

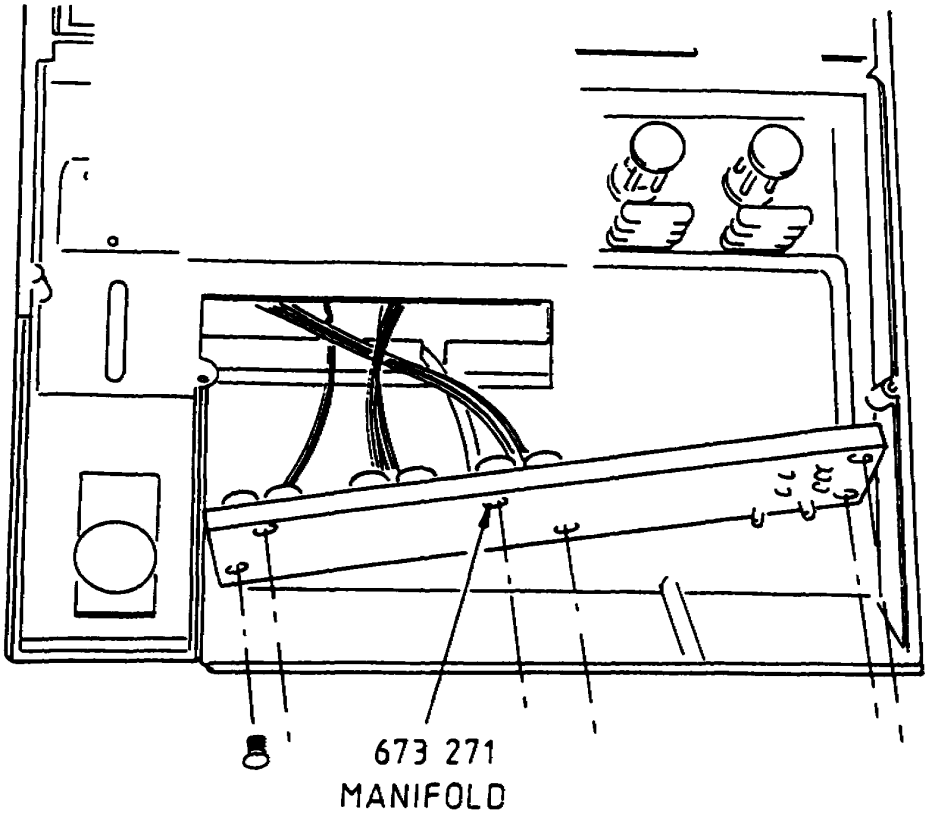
Manifold Cat No. 673271
Solenoid Cat No. 673278

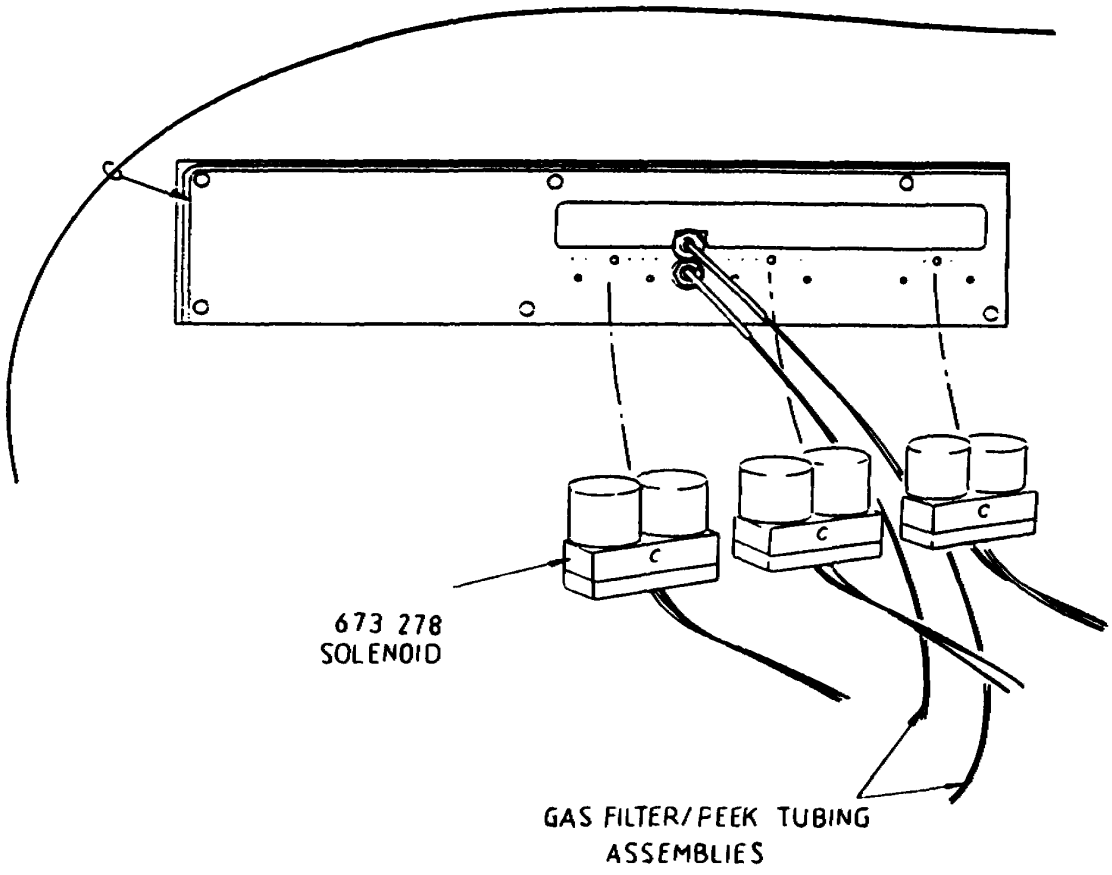
Remove the reagent bottles from the front of the instrument. Place a tissue under the ends of the reagent tubes to soak up excess reagent. Using the maintenance option in the main menu, select the prime option (#32).

Remove the gas cartridges. Power down the 348. Follow the procedure described in section 4.3 to remove the rear cover and panel. Disconnect the three solenoid assemblies from the PSU board. Remove the drip tray connector to the manifold and the pre-heater connector. Remove the two tubing cassettes (sample/waste and reagent) from the manifold.

Remove the reagent tubing and the waste bottle. Unscrew the six nylon screws holding the manifold/solenoid assembly in place. The manifold solenoid assembly can now be eased forward to give access to the solenoid assemblies. If necessary, the gas lines can be disconnected from the manifold to improve access. Remove each of the solenoid assemblies by peeling off the label covering the retaining screws and removing the three retaining screws per solenoid assembly.

When replacing the manifold, ensure that the sealing strip along the top and down the right side is in place. Also ensure the solenoid assemblies are plugged into the correct ports on the PSU board, and the gas lines connected correctly. The line from the 2 should connect to the uppermost of the two gas ports.


673 271
MANIFOLD


673 278
SOLENOID
GAS FILTER/PEEK TUBING
ASSEMBLIES

4.19 To replace the inlet sample detector and pre-heater assembly

Parts required:

Sample detector (inlet) Cat No. 673266
Pre-heater assembly Cat No. 105671

Power down the instrument.

Disconnect the pre-heater from the probe carriage and the manifold. Remove the sample detector cap from the front of the electrode block, exposing the pre-heater retaining screw. Unscrew this screw and remove the perspex pre-heater cover and the pre-heater assembly. Grip the protruding part of the sample detector and pull it forwards to remove it. It can then be replaced.

4.20 To replace the outlet sample detector

Parts required:

Sample detector (outlet) Cat No. 673359

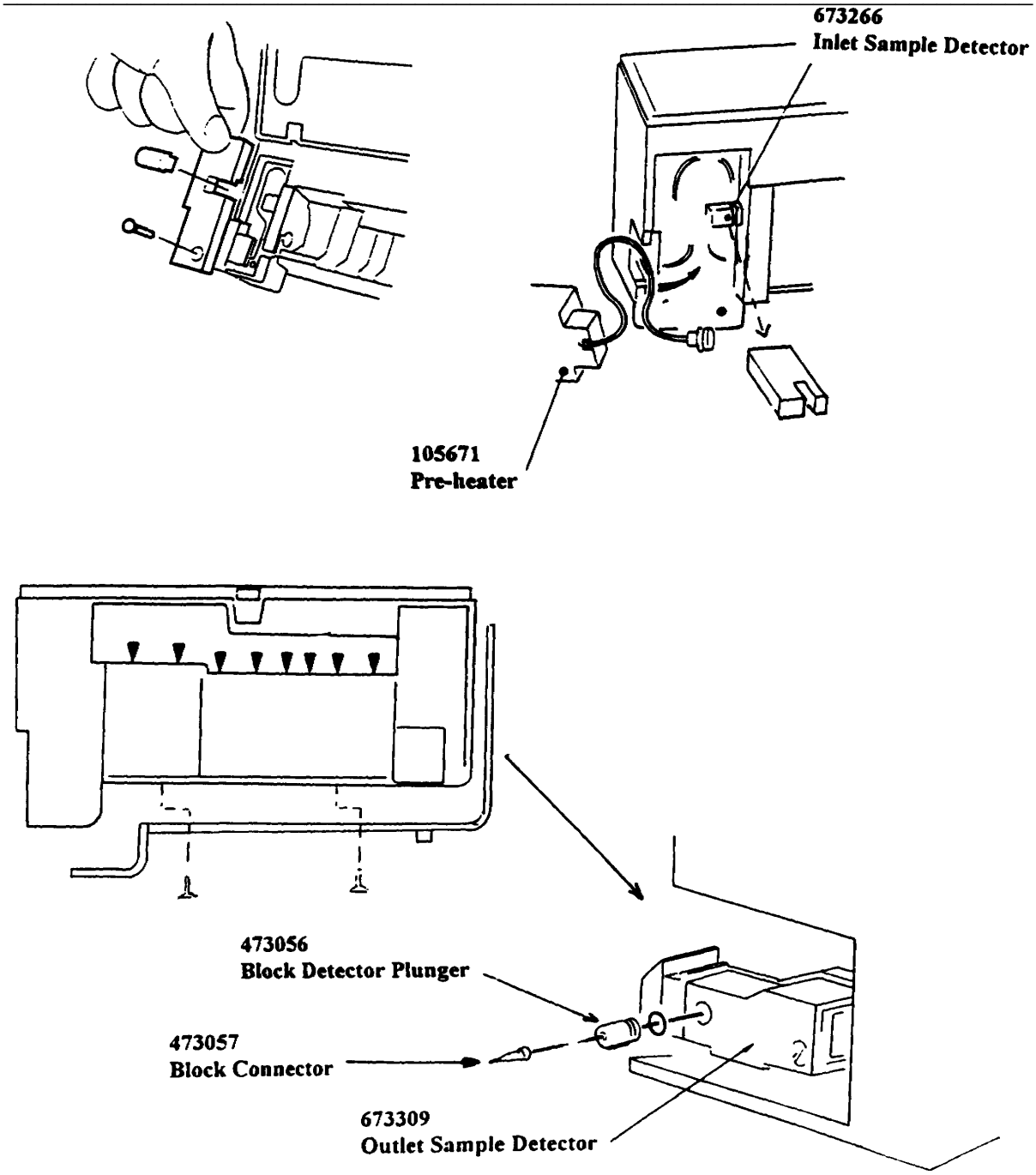
Power down the instrument.

Remove the reference electrode from the electrode block.

Disconnect the tube passing through the outlet sample detector from the sample pump tube and slide it out of the sample detector.

Undo the two plastic screws underneath the electrode block, and lower the lower electrode block cover. This gives access to the sample detector retaining screw. Remove this screw. Slide the sample detector sideways and forward exposing the electrical connector at the rear of the detector. Disconnect this and remove the sample detector.

When replacing the detector, it is easier to replace the tubing by removing the insert in the detector and threading the tubing through this prior to replacement.


673266
Inlet Sample Detector
105671
Pre-heater
473056
Block Detector Plunger
473057
Block Connector
673309
Outlet Sample Detector

4.21 To replace the amplifier board

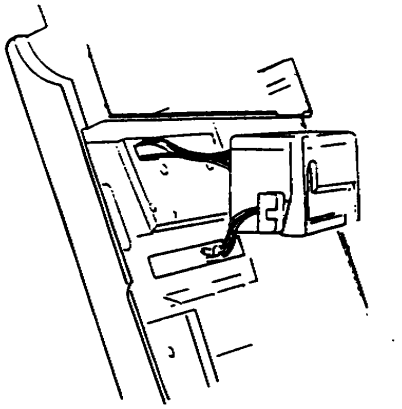
Parts required:

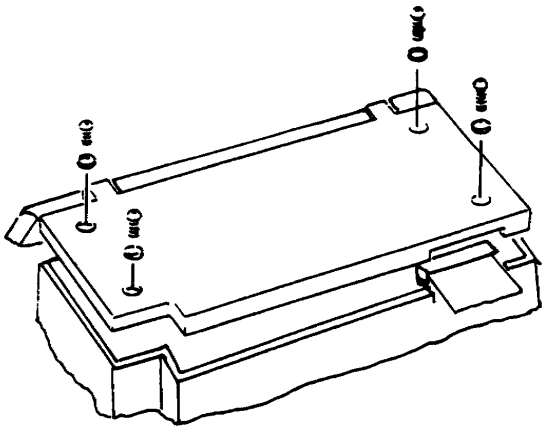
Amplifier board Cat No. 105171

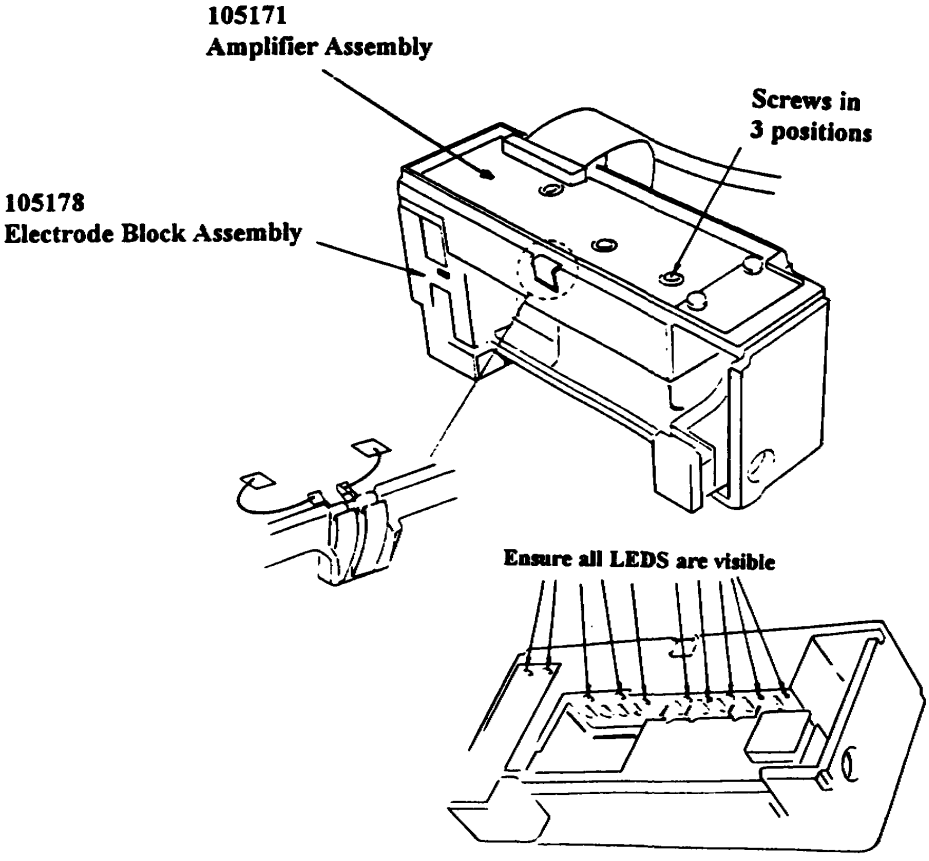
Follow the procedure describes in section 4.3 to remove the rear cover and panel. Disconnect the probe connector to the pre-heater assembly and disconnect the pre-heater to the manifold connector.

Disconnect the tube coming out of the second sample detector from the sample pump tube. Remove all electrodes from the electrode block. Follow the procedure outlined in section 4.3 to remove the PSU board.

Disconnect the two pressure switch connectors. Unscrew the four retaining screws (note their different lengths) holding the electrode block in place. Remove the electrode block assembly. Unscrew the four screws holding the electrode block cover in place. After removing the cover the amplifier board is exposed. Undo the three screws holding the amplifier assembly in place. (The one nearest the ribbon cable connector will need to be unscrewed further than the other two). Once loosened, the amplifier board can be extracted using the tool provided. The two lugs in the tool locate in the two semi-circular holes at either side of the amplifier assembly. The assembly can then be eased out of the electrode block and replaced.






105171
Amplifier Assembly
Screws in
3 positions
105178
Electrode Block Assembly
Ensure all LEDS are visible

4.22 Post Service protocol

On completion of any of the procedures described which necessitate powering down the 348, the following steps should be taken:

i) Reconnect the 348 to the supply.

ii) Select print set-up in the system, set-up part of the main menu (# 67). Check that the set-up is the same as prior to the service procedure. If not, enter the relevant set-up parameters as required.

iii) Once the 348 has reached operating temperature and calibrated measure three levels of !C (eg Certain +) and two levels of Hct control and check that the results are in range.

iv) Initiate a full 2 point calibration (#12).

v) Measure five replicates of a blood sample and check that the CV% is within specification.

vi) Initiate a full 2 point calibration (#12).

5.1 General

Sections 3 and 4 of the operators manual provide extensive maintenance and troubleshooting information. The information contained in this section describes some additional procedures which will aid in determining the resolution of problems within the instrument.

5.2 Power supply checks

Basic indications of whether the main power supplies are functioning can be derived from the status control LEDs (refer to section 5.3).

The following checks are carried out on the PSU PCB. All voltages are measured with respect to Ov (a convenient point is TP6).

Voltage	Test Point	Expected value
+12v	TP1	+11.5 to +12.5
-12v	TP2	-11.5 to -12.5
+5v analogue	TP3	+4.8 to +5.2
-5v analogue	TP4	-4.8 to -5.2
+5v digital	TP5	+4.75 to +5.25

5.3 Status indicator check

The status indicators are located behind the grille on the rear panel. From left to right (viewed from the rear) these LEDs are:

LED	Function	Status
1	Microprocessor	Flashing
2	-12v	On
3	+12v	On
4	-5v analogue	On
5	+5v analogue	On
6	+5v digital	On

5.4 Electrode problems

If there are problems with electrodes, ie unstable readings or out of range readings, a series of steps should be taken:

a) Visually inspect the whole electrode area for signs of KC1 leakage. Remove the electrodes and ensure that no leaks have occurred resulting in alternative conductive paths for signals. Examine the electrode contact for signs of corrosion.

Electrode problems cont'd .....

b) Remove any bubbles from the Reference Electrode. This can be done by tapping or shaking the electrode to manipulate the air bubble into the cassette chamber. The bubble can also be removed by unscrewing the nafion inner by means of the small hexagonal tool in the electrode box and allowing the KC1 solution to flow up and displace the bubble.

c) If the previous two steps are unsuccessful and the pH and electrolyte have sufficient fill solution in them, then deproteinizing and conditioning should be carried out (see Section 4.6 of the Instruction Manual).

Note: After deproteinizing and conditioning the electrodes may take up to 2 hours to return to stable operation.

d) The troubleshooting option (#31) should be used to determine if the electrodes are performing within specification (see Section 5.7 of the Instruction Manual). Large negative millivolt readings are usually indicative of bubbles in the reference electrode. If the test results indicate satisfactory electrode performance and the standardization of the instrument is persistently failing then the problem is probably hydraulic.

e) Frequent occurrences of unstable readings can be due to bad earth connections to the electrode block door. Continuity between the main earth stud on the base plate and the electrode door should be checked.

N.B. The door **must** remain closed in normal operation.

5.5 Hydraulic problems

The main causes of hydraulic problems are leaks, blockages, solenoid failure or pump tube failure.

Various techniques can be utilised in checking for the different hydraulic problems.

Leaks: These will generally be visually evident. In the case of small leaks, crystal build up in the area of the leak will occur.

Blockages: The symptoms which could indicate a blockage would be the failure of liquid to be present as expected during a hydraulic cycle, ie sample not being aspirated during a sample cycle, pH buffer not being delivered to the electrode block during calibration.

If a blockage is suspected, then the techniques for clearing blockages described in section 4.22 of the operators manual should be used.

Hydraulic problems cont'd .....

Solenoid failure: In order to check for solenoid failure, the different fluidic paths need to be checked out.

One method of doing this is to remove the grey connector which connects the manifold to the pre-heater tubing assembly. Initiate a prime sequence (#23). The three ports at the top left-hand corner of the manifold will deliver reagent in the following sequence:

Centre port	-	delivers cal buffer
Right port	-	delivers slope buffer
Left port	-	delivers wash

The gas paths can be checked by using the Run cal gas and Run slope gas routines in the troubleshooting option (#313 and #314). After the initial pre-cal wash has taken place and the sample pump is rotating slowly, the probe can be opened and the probe tip inserted into liquid (a used QC ampoule is appropriate). A stream of bubbles can be observed emanating from the tip of the probe. Turning off the gas at the gas bottle and checking that the gas flow ceases will determine that the correct gas is being delivered into the electrode block.

Pump tube failures: Certain pump tube failures are obvious, eg tubes splitting. If, however, the failure is as a result of reduced flow rate in one of the tubes due to wear, or blocked filters, then it will not be so obvious.

Utilising the Run cal and slope buffers in the Troubleshooting option (#311 and #312) and inspecting what occurs at the T-junction in the pre-heater will give some good indications of pump tube condition. When the buffers are pumped into the block via the T-junction, more solution is delivered than the sample pump will take away. This results in some flow back from the T-junction towards the sample probe. If this flow back does not happen, or is minimal, then the pump tubes will need changing.

5.6 System re-starts

The 348 software continually checks its own internal data store in case of corruption. It also monitors the incoming power status to achieve controlled recovery from intermittent power interruption, brown outs, etc. Dependent on the condition under which the breakdown occurred, the 348 will re-start in a number of different ways.

5.6.1 Cold start

Conditions under which this will occur:

First time power up
Power up with new CPU board
Power up with failed on-board battery
Power up with reset button held in. (The reset button is located between the two data ports on the rear panel - it must be held in until a double beep is heard).

Status on restart:

All settable options reset to default values (except factory set pO2 channel offset)
Sample and QC number set to zero
Calibration will be two 2pt calibrations 10 minutes apart once the system has achieved operating temperature

5.6.2 Tepid start

a) When powered up with a new version of software in which significant change has been made (eg default correlation factors changed)

Status on restart:

All settable options reset to default with the following exceptions:

BP calibration
Sample number
Real time clock
ID number
Service telephone number
Language

A 2pt calibration will be forced. Hct slope will be prompted.

b) Conditions under which this will occur:

When powered up with a new version of software in which no significant change has happened (eg new language capability added).

Status on restart:

As for a warm start (see section 5.6.3) with a 2pt calibration forced and Hct slope prompted.

5.6.3 Warm Start

Conditions under which this will occur:

Power interruption long enough to cause a processor reset.

Status on restart:

Nothing changed

Calibration

If the electrode block is still inside operating temperature limits the calibration sequence will not be affected and after a brief display of “warming up”, the Ready screen will be displayed. If the electrode block is outside temperature limits, then two 2pt calibrations 10 minutes apart will be initiated once the system achieves operating temperature.

5.6.4 Ram Corruption restart

Conditions under which this will occur:

Corruption RAM checksum

Status at restart:

Dependent on where corruption occurred.

If calibration is affected two 2pt calibrations 10 minutes apart will be initiated.

If other data is corrupted, default values will be assumed.

If sample data is corrupted, data recall will signal no data available.

On restart, the centre of the display will have “check set-up” flashing. Pressing the * key will cancel this message. It is advisable to check the options in operating set-up (#5) and system set-up (#6) if this occurs.

6.1 Ordering information

When ordering spares or accessories for the 348 please give the following information to your Chiron Diagnostics distributor:

348 serial number
Catalogue number of part (Cat.)
Description
Quantity required

This will ensure that your order is dealt with quickly and efficiently.

The number shown in the third column (Quantity) is the quantity supplied against the stated catalogue number. If the quantity is greater than 1, only multiples of that quantity can be supplied.

Catalogue number	Description	Quantity
478648	Fuse pack UL/CSA	2 per pk
478916	Fuse pack IEC	2 per pk
478937	Voltage select bobbin	1
106195	CPU board	1
106225	PSU board	1
105171	Amplifier board	1
673263	Display module	1
105177	Memory card	1
673284	Probe sensor assembly	1
673285	Probe lever	1
673286	Probe bracket	1
673266	Sample detector (inlet)	1
673359	Sample detector (outlet)	1
473745	Fan	1
673267	Printer head	1
673269	Printer cover	1
673268	Printer cradle	1
478666	Motor/gearbox kit	1
478664	Rotor kit	1
814013001	BP sensor	1
673278	Solenoid assembly	1
673270	Keypad	1
673271	Manifold	1
105178	Electrode block assembly	1
105185	Gas restrictor kit	1
673274	Tube tensioner kit	1
673265	Memory card sealing strip	1
105223	Transformer and mains inlet assembly	1

673281	Main bulkhead	1
673282	Main cover	1
673283	Display moulding	1
673275	Hardware kit	1
673276	'O' ring kit	1
106122	348 service manual	1
105227	Display window	1
473050	Block extension spring	1
473051	Catch moulding	1
473055	Block thermistor assembly	1
473056	Detector plunger	1
473057	Block connector	1
570000	Rotor knob kit	1
673366	Solenoid screw labels	pk of 10
673367	PCB brackets	pk of 3
673368	Sample detector access cover	1
673369	Rubber feet	pk of 4
673370	Power inlet	1
105260	Rear cover	1
106193	Gas cartridge cover	1
105170	Gas regulator/pressure switch assembly	1

6.2 Engineering Spares Kit

As most parts are common with the 248, there is not a complete engineering spares kit. There is an addition kit, catalogue number 108571. This kit should be used in conjunction with either

673279 Engineering Spares Kit
or
673363 248 Spares Kit (level 1)

The contents of the addition kit, 108571 are:

Catalogue number	**Description**
105170	Gas regulator (pressure switch assembly)
105171	Amplifier assembly
105177	Memory card kit
105185	Gas restrictor kit
105673	Pump tube kit
105672	Bottle tubing kit
105671	Pre-heater kit

7.1 Introduction

The hydraulic sequences are set out as a series of tables. Sub-sequences are given in detail and overall sequences as a set of sub-sequences. For example the full 1 point sequence is given as a set of references to the sub-sequences that make it up.

The numbers in the columns referring to the sample and reagent pumps are voltages. The sample pump voltage is always negative. The reagent pump voltage is always positive except for a small number of occasions when the pump runs backward and then the voltage is negative.

7.2 Sequences

See pages 45 - 51.

7.2.1 Sample Sequence

Step	Action	Pumps		Solenoids						End State
		Sample	Reagent	V1	V2	V3	V4	V5	V6	
1	Aspirate	2.966	Off	Off	Off	Off	Off	Off	Off	3 Secs
2	Aspirate	1.374	Off	Off	Off	Off	Off	Off	Off	SD1 detects LE
3	Aspirate	1.374/Off	Off	Off	Off	Off	Off	Off	Off	SD1 detects TE
4	Measure	Off	Off	Off	Off	Off	Off	Off	Off	End of Measure
5	Wash									

Note : For step 3 the sample motor alternates between 1.374 and off.
For step 5 see section 7.2.4

7.2.2 QC Sequence

Step	Action	Pumps		Solenoids						End State
		Sample	Reagent	V1	V2	V3	V4	V5	V6	
1	Aspirate	2.966	Off	Off	Off	Off	Off	Off	Off	SD1 detects LE
2	Aspirate	2.966	Off	Off	Off	Off	Off	Off	Off	SD2 detects LE
3	Aspirate	2.966	Off	Off	Off	Off	Off	Off	Off	3 Secs
4	Measure	Off	Off	Off	Off	Off	Off	Off	Off	End of Measure
5	Wash									

Note : For step 5 see section 7.2.4

7.2.3 Hct Slope Sequence

Step	Action	Pumps		Solenoids						End State
		Sample	Reagent	V1	V2	V3	V4	V5	V6	
1	Aspirate	2.966	Off	Off	Off	Off	Off	Off	Off	SD1 detects LE
2	Aspirate	2.966	Off	Off	Off	Off	Off	Off	Off	SD2 detects LE
3	Aspirate	2.966	Off	Off	Off	Off	Off	Off	Off	3 Secs
4	Measure	Off	Off	Off	Off	Off	Off	Off	Off	End of Measure
5	Wash									

Note : For step 5 see section 7.2.4

7.2.4 Sample Wash Sequence

Step	Action	Pumps		Solenoids						End State
		Sample	Reagent	V1	V2	V3	V4	V5	V6	
1	Wash Probe	Off	7.523	On	Off	Off	Off	Off	Off	1.5 Secs
2	Clear Block	7.523	Off	Off	Off	Off	Off	Off	Off	4 Secs
3	Prime Wash	7.523	7.523	On	Off	Off	Off	Off	Off	1 LE or 8 Secs
4	Clear Block	7.523	Off	Off	Off	Off	Off	Off	Off	4 Secs
5	Refresh Slope	7.523	7.523	Off	Off	Off	Off	Off	On	0.5 Secs
6	Clear Block	7.523	7.523	Off	Off	Off	Off	Off	Off	1 Sec
7	Refresh Cal	7.523	7.523	Off	Off	Off	Off	On	Off	0.5 Secs
8	Clear Block	7.523	7.523	Off	Off	Off	Off	Off	Off	2 Secs
9	Wash	7.523	7.523	On	Off	Off	Off	Off	Off	0.5 Secs
10	Air	7.523	7.523	Off	Off	Off	Off	Off	Off	0.5 Secs
11-16	Repeat steps 9-10 3 times									
17	Wash	7.523	7.523	On	Off	Off	Off	Off	Off	0.5 Secs
18	Clear Block	7.523	Off	On	Off	Off	Off	Off	Off	1 Sec
19	Clear Wash	7.523	-2.025	On	Off	Off	Off	Off	Off	2 Secs
20	Vent Slope Gas	Off	Off	Off	On	Off	On	Off	Off	4 Secs
21	Clear Block	2.025	Off	Off	On	Off	On	Off	Off	10 Secs

7.2.5 Full 1 Point Sequence

Step	Sequence	Reference
1	Cal pH/Lytes	7.2.11
2	Gas Cal	7.2.13
3	Cal Wash	7.2.15

7.2.6 Full 2 Point Sequence

Step	Sequence	Reference
1	Cal pH/Lytes	7.2.11
2	Slope pH/Lytes	7.2.12
3	Gas Cal	7.2.13
4	Gas Slope	7.2.14
5	Cal Wash	7.2.15

7.2.7 Gas 1 Point Sequence

Step	Sequence	Reference
1	Gas Cal	7.2.13
2	Cal Wash	7.2.15

7.2.8 Gas 2 Point Sequence

Step	Sequence	Reference
1	Gas Cal	7.2.13
2	Gas Slope	7.2.14
3	Cal Wash	7.2.15

7.2.9 pH/Lytes 1 Point Sequence

Step	Sequence	Reference
1	Cal pH/Lytes	7.2.11
3	Cal Wash	7.2.15

7.2.10 pH/Lytes 2 Point Sequence

Step	Sequence	Reference
1	Cal pH/Lytes	7.2.11
2	Slope pH/lytes	7.2.12
3	Cal Wash	7.2.15

7.2.11 Cal pH/lytes Sequence

Step	Action	Pumps		Solenoids						End State
		Sample	Reagent	V1	V2	V3	V4	V5	V6	
1	Aspirate Cal	1.808	2.025	Off	Off	Off	Off	On	Off	4 Secs
2	Aspirate Air	1.808	2.025	Off	Off	Off	Off	Off	Off	3 Secs
3	Aspirate Cal	1.808	2.025	Off	Off	Off	Off	On	Off	1 Sec
4	Aspirate Air	1.808	2.025	Off	Off	Off	Off	Off	Off	1 Sec
5-12	Repeat steps 3-4 4 times									
13	Aspirate Cal	1.808	2.025	Off	Off	Off	Off	On	Off	1 Sec
14	Aspirate Air	1.808	2.025	Off	Off	Off	Off	Off	Off	11 Secs
15	Aspirate Cal	1.808	2.025	Off	Off	Off	Off	On	Off	SD2 detects LE
16	Measure	Off	Off	Off	Off	Off	Off	Off	Off	End of Measure

7.2.12 Slope pH/lytes Sequence

Step	Action	Pumps		Solenoids						End State
		Sample	Reagent	V1	V2	V3	V4	V5	V6	
1	Aspirate Air	7.523	Off	Off	Off	Off	Off	Off	Off	4 Secs
2	Aspirate Wash	7.523	7.523	On	Off	Off	Off	Off	Off	1 Sec
3	Clear Wash	7.523	Off	On	Off	Off	Off	Off	Off	1 Sec
4	Clear Wash	7.523	-2.025	On	Off	Off	Off	Off	Off	2 Sec
5	Prime Slope	1.808	2.315	Off	Off	Off	Off	Off	Off	3 Secs
6	Aspirate Slope	1.808	2.315	Off	Off	Off	Off	Off	On	4 Secs
7	Aspirate Air	1.808	2.025	Off	Off	Off	Off	Off	Off	8 Secs
8	Aspirate Slope	1.808	2.315	Off	Off	Off	Off	Off	On	SD2 detects LE
9	Measure	Off	Off	Off	Off	Off	Off	Off	Off	End of Measure

7.2.13 Gas Cal Sequence

Step	Action	Pumps		Solenoids						End State
		Sample	Reagent	V1	V2	V3	V4	V5	V6	
1	Clear Block	7.523	Off	Off	Off	Off	Off	Off	Off	2 Secs
2	Aspirate Wash	7.523	7.523	On	Off	Off	Off	Off	Off	1 Sec
3	Aspirate Air	7.523	Off	Off	Off	Off	Off	Off	Off	1 Sec
4	Clear Wash	7.523	-2.025	On	Off	Off	Off	Off	Off	2 Secs
5	Clear Cal	7.523	-2.025	Off	Off	Off	Off	On	Off	7 Secs
6	Vent Cal Gas	Off	Off	Off	On	Off	Off	Off	Off	10 Secs
7	Aspirate Gas	2.749	Off	Off	Off	On	Off	Off	Off	End of Measure
8	Measure	2.749	Off	Off	Off	On	Off	Off	Off	End of Measure

7.2.14 Gas Slope Sequence

Step	Action	Pumps		Solenoids						End State
		Sample	Reagent	V1	V2	V3	V4	V5	V6	
1	Remove Gas	7.523	Off	Off	Off	Off	Off	Off	Off	10 Secs
2	Vent Slope Gas	Off	Off	Off	On	Off	On	Off	Off	5 Secs
3	Prime Slope Gas	Off	Off	Off	Off	On	On	Off	Off	5 Secs
4	Aspirate Gas	2.749	Off	Off	Off	On	On	Off	Off	End of Measure
5	Measure	2.749	Off	Off	Off	On	On	Off	Off	End of Measure

7.2.15 Cal Wash Sequence

Step	Action	Pumps		Solenoids						End State
		Sample	Reagent	V1	V2	V3	V4	V5	V6	
1	Clear Block	7.523	Off	Off	Off	Off	Off	Off	Off	4 Secs
2	Prime Slope	7.523	7.523	Off	Off	Off	Off	Off	On	0.5 Secs
3	Clear Block	7.523	7.523	Off	Off	Off	Off	Off	Off	1 sec
4	Prime Cal	7.523	7.523	Off	Off	Off	Off	On	Off	3 LEs or 5 Secs
5	Clear Block	7.523	7.523	Off	Off	Off	Off	Off	Off	6 TEs or 6 Secs
6	Aspirate Air	7.523	7.523	Off	Off	Off	Off	Off	Off	1 sec
7	Prime Wash	7.523	7.523	On	Off	Off	Off	Off	Off	1 LE or 8 Secs
8	Wash	7.523	7.523	On	Off	Off	Off	Off	Off	0.5 Secs
9	Air	7.523	7.523	Off	Off	Off	Off	Off	Off	0.5 Secs
10-13	Repeat steps 8-9 2 times									
14	Clear Block	7.523	Off	On	Off	Off	Off	Off	Off	1 Sec
15	Clear Wash	7.523	-2.025	On	Off	Off	Off	Off	Off	2 Secs
16	Vent Slope Gas	Off	Off	Off	On	Off	On	Off	Off	4 Secs
17	Clear Block	2.025	Off	Off	On	Off	On	Off	Off	10 Secs

7.2.16 Prime Sequence

Step	Action	Pumps		Solenoids						End State
		Sample	Reagent	V1	V2	V3	V4	V5	V6	
1	Prime Cal, Vent Cal Gas	7.523	7.523	Off	On	Off	Off	On	Off	15 Secs
2	Prime Slope, Vent Cal Gas	7.523	7.523	Off	On	Off	Off	Off	On	15 Secs
3	Prime Wash, Vent Slope Gas	7.523	7.523	On	On	Off	On	Off	Off	15 Secs
4	Clear Block	7.523	7.523	Off	Off	Off	Off	Off	Off	6 Secs

7.2.17 Deproteinise/Disinfect Sequence

Step	Action	Pumps		Solenoids						End State
		Sample	Reagent	V1	V2	V3	V4	V5	V6	
1	Aspirate Solution	2.955	Off	Off	Off	Off	Off	Off	Off	4.5 Secs
2	Aspirate Solution (slow)	1.374	Off	Off	Off	Off	Off	Off	Off	SD2 detects LE
3	Aspirate Solution (fast)	3.92	Off	Off	Off	Off	Off	Off	Off	11 Secs
4 or	Deproteinise	Off	Off	Off	Off	Off	Off	Off	Off	5 Mins
4	Disinfect	Off	Off	Off	Off	Off	Off	Off	Off	10 Mins
5	Wash									

Note: For step 5 see section 7.2.4

7.2.18 Condition Sequence

Step	Action	Pumps		Solenoids						End State
		Sample	Reagent	V1	V2	V3	V4	V5	V6	
1	Aspirate Solution	2.955	Off	Off	Off	Off	Off	Off	Off	4.5 Secs
2	Aspirate Solution (slow)	1.374	Off	Off	Off	Off	Off	Off	Off	SD2 detects LE
3	Condition	Off	Off	Off	Off	Off	Off	Off	Off	5 Mins
4	Wash									

Note: For step 4 see section 7.2.4

7.2.19 Background Sequence

Step	Sequence	Timing	Reference
1	Vent Gas	After 5 mins inactivity	7.2.20
2	Vent Gas	After a further 5 mins	7.2.20
3	Int Wash	After a further 5 mins	7.2.21
4	Go to step 1	After a further 5 mins	

7.2.20 Vent Gas Sequence

Step	Action	Pumps		Solenoids						End State
		Sample	Reagent	V1	V2	V3	V4	V5	V6	
1	Vent Slope Gas	Off	Off	Off	On	Off	On	Off	Off	1 Sec
2 or	Vent Cal Gas	Off	Off	Off	On	Off	Off	Off	Off	1 Sec
2	Vent Cal Gas	Off	Off	Off	On	Off	Off	Off	Off	4 Secs

7.2.21 Intermediate Wash Sequence

Step	Action	Pumps		Solenoids						End State
		Sample	Reagent	V1	V2	V3	V4	V5	V6	
1	Aspirate Wash	7.523	7.523	On	Off	Off	Off	Off	Off	1 LE or 8 secs
2	Clear Wash	7.523	Off	Off	Off	Off	Off	Off	Off	4 Secs
3	Backflush Wash	7.523	-2.025	On	Off	Off	Off	Off	Off	2 Secs
4	Vent Slope Gas	Off	Off	Off	On	Off	On	Off	Off	4 Secs
5	Clear Block	2.025	Off	Off	On	Off	On	Off	Off	10 Secs

Schedule 1 - PSU to electrode block

Electrode block signal	**PSU (PL1)**
Block heater supply	1
Block heater control	2
Pre-heater supply	3
Pre-heater control	4
N/C	5
N/C	6
Voltage reference	7
Pre-heater temperature sense voltage	8
Voltage reference	9
Block temperature sense voltage	10

Note: pins 7 and 0 are linked on the PSU board

Electrode block signal	**PSU (PL2)**
SD1 LED voltage supply	1
SD2 LED voltage supply	2
SD1 voltage on/off control	3
SD2 LED voltage on/off control	4
SD1 sense voltage	5
Ov analogue	6
SD2 sense voltage	7
Ov analogue	8

Note: pins 6 and 8 are linked to the PSU board

Schedule 2 - PSU to BP sensor

BP sensor signal	**PSU (PL3)**
BP sensor voltage supply	1
BP sensor sense voltage	2
Ov analogue	3

Schedule 3 - PSU to probe

Probe signal	**PSU (PL4)**
Voltage reference to thermistor	1
Thermistor sense voltage	2
Syringe position detector output	3
Ov digital	4
Home position detector output	5
Ampoule position detector output	6
Ov digital	7

Note: pins 4 and 7 are linked on the PSU board

Schedule 4 - PSU to amplifier PCB

Amplifier board SK5	Signal	PSU (PL14)
1	+12v	1
2	-12v	3
3	Hematocrit measure enable (HCTEN)	5
4	Sample chamber LEDs control (LEDOFF)	6
5	N/C	
6	N/C	
		PSU (PL5)
7	Mux select (Port 4*0)	1
8	Mux select (Port 4*1)	2
9	Mux select (Port 4*2)	3
10	Mux select (MuxSel l)	4
11	-5v analogue	5
12	-5v analogue	6
13	+5v analogue	7
14	+5v analogue	8
15	Ov analogue	9
16	Ov analogue	10
17	Voltage reference (VRefBuf)	11
18	Ov analogue	12
19	Voltage offset (Voffset)	13
20	Ov analogue	14
21	Mux output (AnalogIn)	15
22	Ov analogue	16
23	Mux select (MuxSel 2)	17
24	Ov analogue	18
25	Ov analogue	19
26	Ov analogue	20

Schedule 5 - PSU to fan

Fan signal	PSU (PL6)
Ov (12 volt supply)	1
-12v	2

Schedule 6 - PSU to CPU

CPU (SK7)	Signal	PSU (PL7)
A1	+5v digital	A1
A2	+5v digital	A2
A3	+5v digital	A3

Schedule 6 - PSU to CPU cont'd .....

A4	Ov digital	A4
A5	Ov digital	A5
A6	Ov digital	A6
A7	-12v	A7

CPU (SK7)	**Signal**	**PSU (PL7)**
A8	Ov digital	A8
A9	+12v	A9
A10	+22v	A10
A11	N/C	A11
A12	100	A12
A13	101	A13
A14	102	A14
A15	103	A15
A16	104	A16
A17	105	A17
A18	106	A18
A19	107	A19
A20	+5v digital	A20
A21	+5v digital	A21
A22	N/C	A22
A23	Disable P	A23
A24	Probe - home position detector output	A24
A25	Probe - syringe position detector output	A25
A26	Ov digital	A26
A27	SD1 output	A27
A28	SD2 output	A28
A29	+5v analogue	A29
A30	-5v analogue	A30
A31	Ov analogue	A31
A32	Voltage reference (VRefBuf)	A32
B1	+5v digital	B1
B2	+5v digital	B2
B3	+5v digital	B3
B4	Ov digital	B4
B5	Ov digital	B5
B6	Ov digital	B6
B7	-12v	B7
B8	Ov digital	B8
B9	+12v	B9
B10	+22v	B10
B11	N/C	B11

Schedule 6 - PSU to CPU cont'd .....

B12	Se10	B12
B13	Se11	B13
B14	Se12	B14
B15	Se13	B15
B16	Se14	B16
B17	Se15	B17
B18	Se16 (not used)	B18
B19	Se17 (not used)	B19
B20	ADDCLK	B20
B21	ADCDATA	B21
B22	Port 101	B22
B23	Port 102	B23
B24	Port 103	B24
B25	Probe - ampoule position detector output	B25
B26	Oc digital	B26
B27	N/C	B27
B28	Voltage threshold	B28
B29	+5v analogue	B29
B30	-5v analogue	B30
B31	Ov analogue	B31
B32	Temp4	B32

Note: The following pins are all linked (separately by function) on both the CPU and PSU:

+5v digital
Ov digital
+5v analogue
-5v analogue
Ov analogue
+12v
-12v
+22v

Schedule 7 - PSU to solenoids

Solenoid signal	**PSU (PL8)**
+12v	1
pH Cal on/off (V5)	2
+12v	3
Wash on/off (V1)	4

Schedule 7 - PSU to solenoids cont'd .....

	PSU (PL9)
+12v	1
Vent on/off (V2)	2
+12v	3
Gas select on/off (V4)	4

	PSU (PL10)
+12v	1
pH Cal/gas select on/off (V3)	2
+12v	3
pH slope on/off (V6)	4

Note: All +12v pins are linked on the PSU board

Schedule 8 - PSU to transformer

Transformer	**PSU (PL11)**
18 VAC (secondary a)	1
18 VAC (secondary a)	2
18 VAC (secondary b)	3
18 VAC (secondary b)	4
18 VAC (secondary c)	5
18 VAC (secondary c)	6
System ground	7
N/C	8

Schedule 9 - PSU to pump motors

Pump motor signal	**PSU (PL12)**
Reagent pump drive voltage	1
Ov (12v supply)	2

	PSU (PL13)
Ov (12v supply)	1
Sample/waste pump drive voltage	2

Schedule 10 - PSU to gas chassis

Gas chassis signal	**PSU (PL14)**
Cal pressure switch	4
Slope pressure switch	9
+5v digital	10

Schedule 11 - CPU to display

Display module	**CPU (PL1)**
+5v (display)	1
N/C	2
Ov digital	3

Display Module	**CPU (PL3)**
Ov digital	1
Display data bit 7	2
Ov digital	3
Display data bit 6	4
Ov display	5
Display data bit 5	6
Ov digital	7
Display data bit 4	8
Ov digital	9
Display data bit 3	10
Ov digital	11
Display data bit 2	12
Ov digital	13
Display data bit 1	14
Ov digital	15
Display data bit 0	16
Ov display	17
Control bit 1	18
Ov display	19
Control bit 2	20
Ov display	21
Control bit 3	22
Ov display	23
Control bit 4	24
Control bit 5	25
N/C	26

Note: All Ov digital pins are linked on the CPU board

Schedule 12 - CPU to printer

Printer signal	**CPU (PL2)**
Control line 1	1
Control line 2	2
Control line 3	3
Control line 4	4

Schedule 12 - CPU to printer cont'd .....

+5v (printer)	5
+5v (printer)	6
+5v (printer)	7
Dot 8	8
Dot 7	9
Dot 6	10
Dot 5	11
Dot 4	12
Dot 3	13
Dot 2	14
Dot 1	15
Control line 5	16
Control line 6	17
Control line 7	18
Control line 8	19
+5v (printer)	20
+5v (printer)	21
Ov digital	22
Position sense output	23

Note: All 5 volt (printer) pins are lined on the CPU board

Schedule 13 - CPU to data ports

Data port 2 signal	**CPU (PL4)**
N/C	1
Tx data	2
Rx data	3
DTR	4
Ov digital	5
N/C	6
N/C	7
CTS	8
+5v digital	9

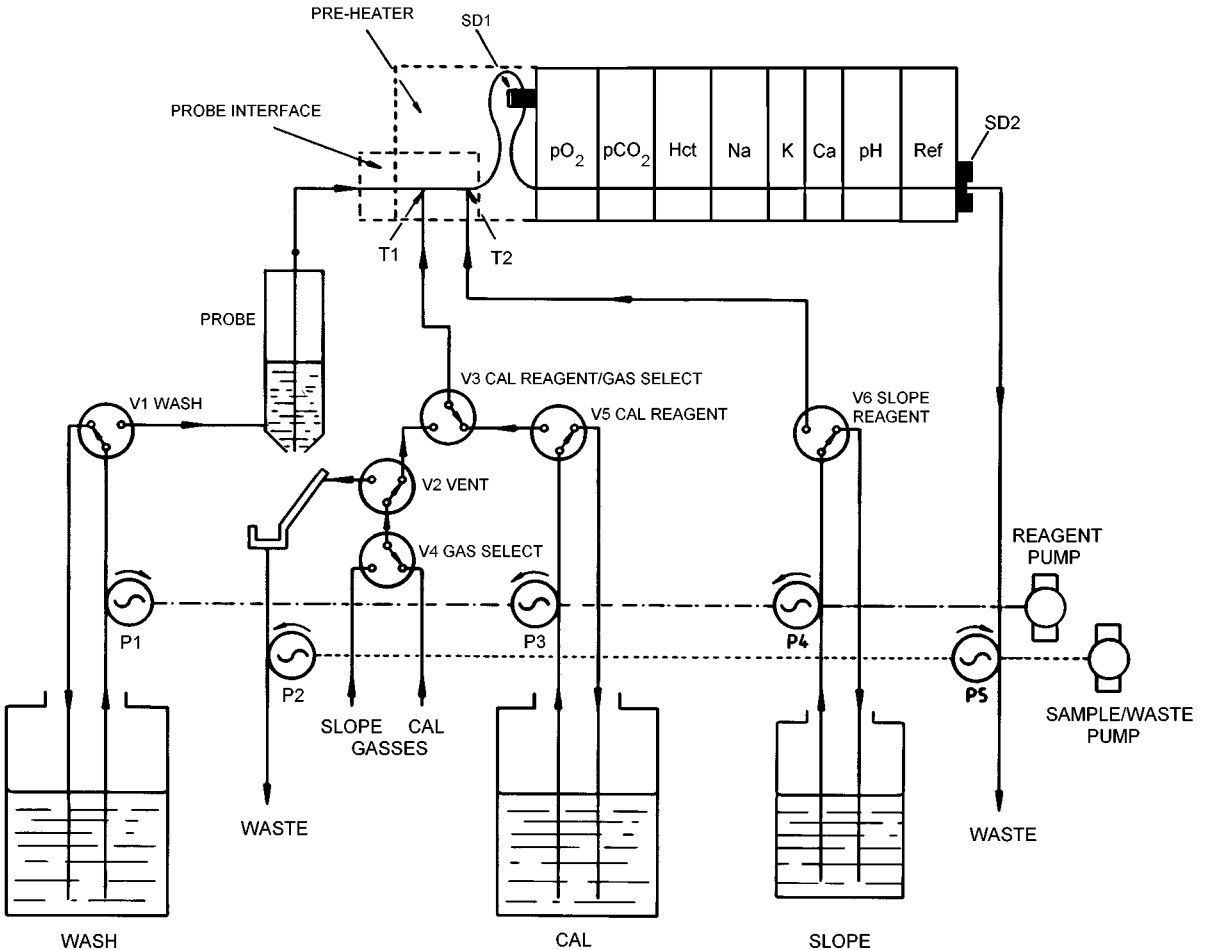
Data port 1 signal	**CPU (PL5)**
N/C	1
Tx data	2
Rx data	3
DTR	4
Ov digital	5

Schedule 13 - CPU to data ports cont'd .....

N/C	6
N/C	7
CTS	8
N/C	9

Schedule 14 - CPU to keypad

Keypad signal	**CPU (PL6)**
Row 1 (*, #, 1, 2, 3, 4, 5, 6)	1
Row 2 (7, 8, 9, 0. C, ,. PF)	2
N/C	3
Ov digital	4
Column 1 (*, 7)	5
Column 2 (#, 8)	6
Column 3 (1, 9)	7
Column 4 (2, 0)	8
Column 5 (3, C)	9
Column 6 (4, .)	10
Column 7 (5, PF)	11
Column 8 (6)	12
+5v digital	13
N/C	14



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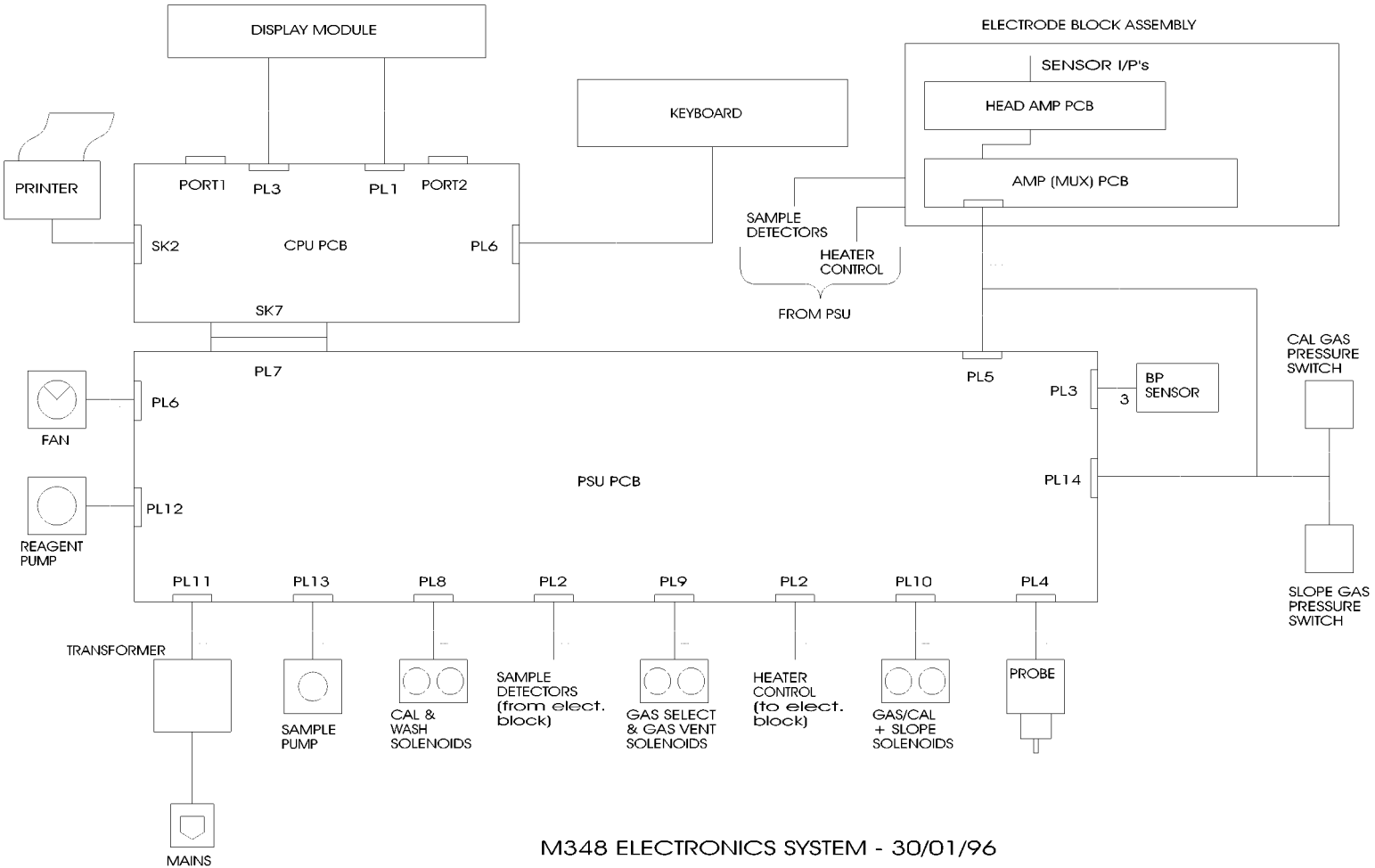

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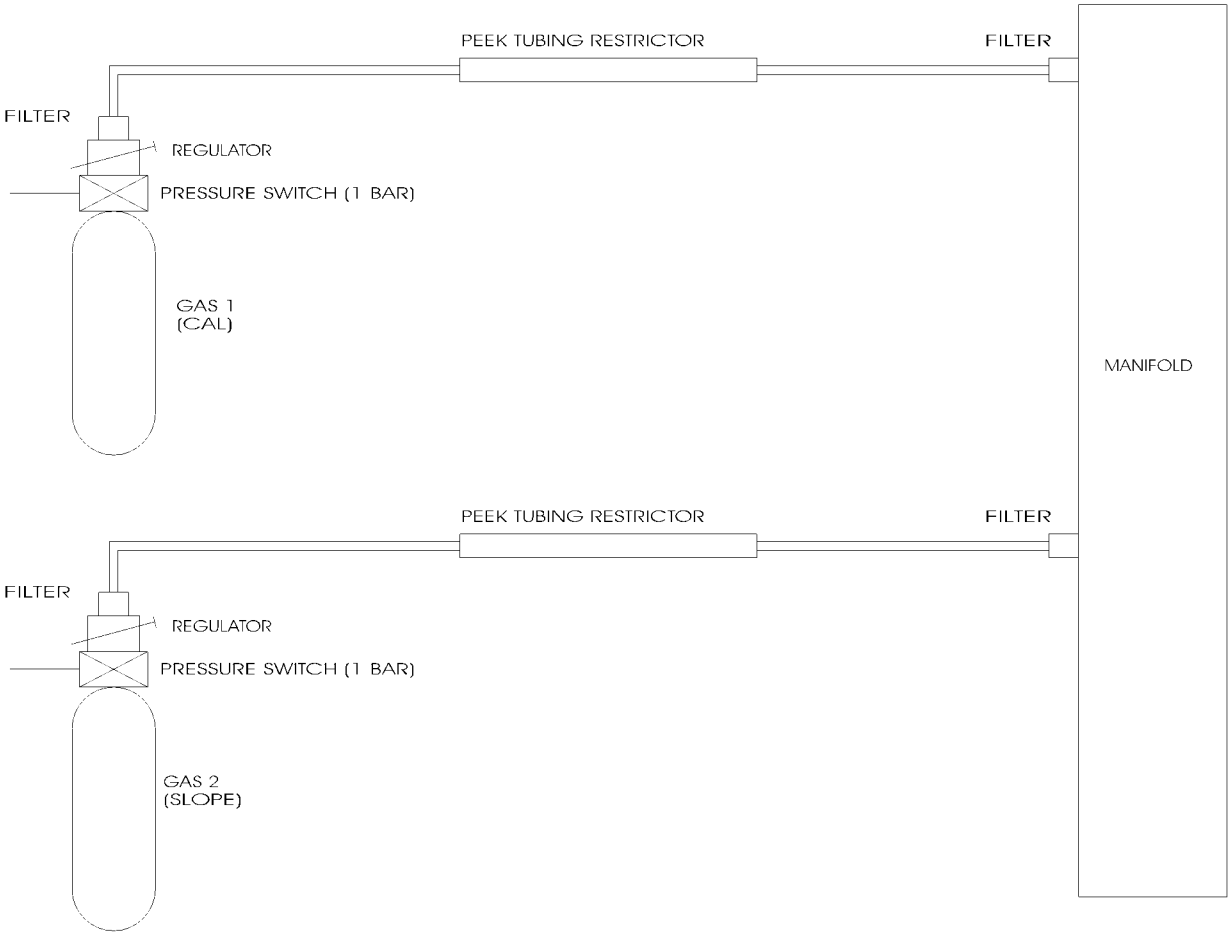

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